Engineering
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CONSTRUCTION TRENDS

Notes on significant movements in the construction industry

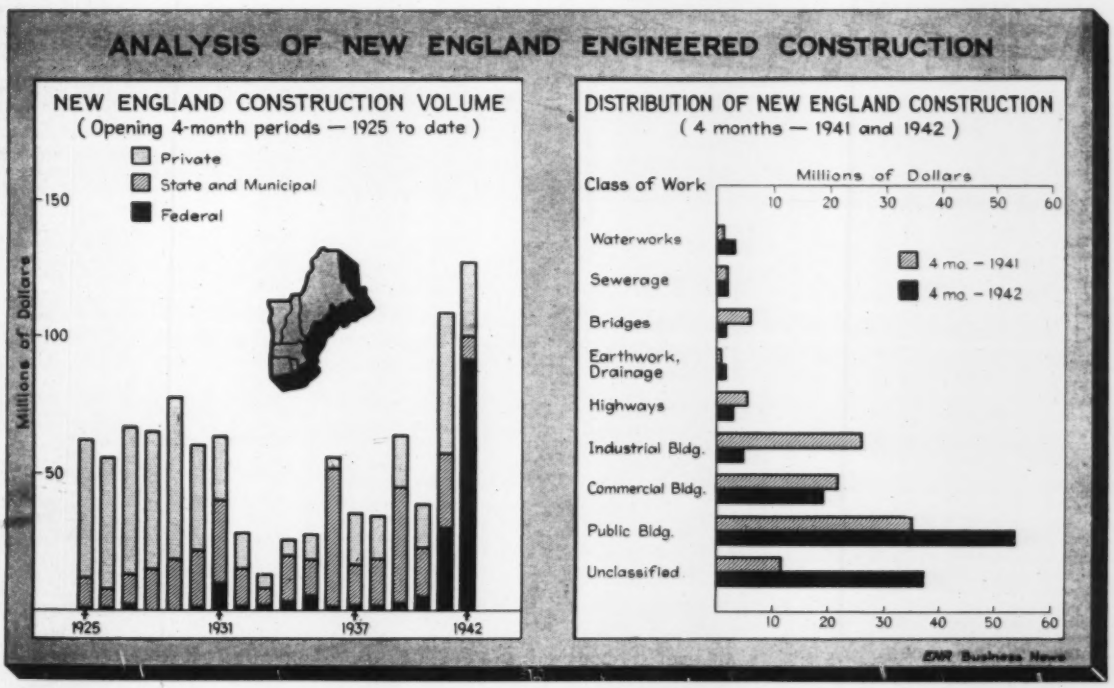
New England Construction Tops 1941 Peak

NEW ENGLAND ENGINEERING construction volume climbed to $126,803,000 for the opening four months of 1942, a new record peak 17 percent above the former high reported for the corresponding period last year. Approximately three-quarters of the current year's volume, $92,186,000, was federally financed, an increase of 206 percent over the 1941 four-month total; 21 percent, or $27,012,000, was for private work; and the balance, $7,605,000, was for state and municipal construction. Both private and state and municipal construction dropped sharply from a year ago, the private total declining 47 percent, and the state and municipal volume 72 percent.

The two classes of construction most directly concerned with the war program, public buildings and unclassified construction, were responsible for 71.8 percent of the New England volume. Public buildings —camps, cantonments, federally-financed war plants, defense housing, etc.—accounted for 42.4 percent of the region's 1942 total, and gained 53 percent over last year. Unclassified construction—shipyards, shipways, airbases, airports, naval bases, etc.—made up 29.4 percent of the volume and more than tripled the 1941 four-month figure.

Private industrial buildings were responsible for 5.6 percent of the New England construction total: commercial building and large-scale private housing, 15.2 percent; waterworks facilities, 2.1 percent; streets and roads, 2.0 percent; sewerage systems and treatment plants, 1.2 percent; earthwork and drainage structures, 1.1 percent; and bridge construction, 1.0 percent.

In addition to the gains reported for public buildings and unclassified construction, the waterworks total was 188 percent over a year ago, and earthwork and drainage climbed 126 percent. However, the 1942 four-month industrial building volume declined 73 percent; commercial building was 12 percent lower; streets and roads, 52 percent; bridges, 77 percent; and sewerage construction, 2 percent.



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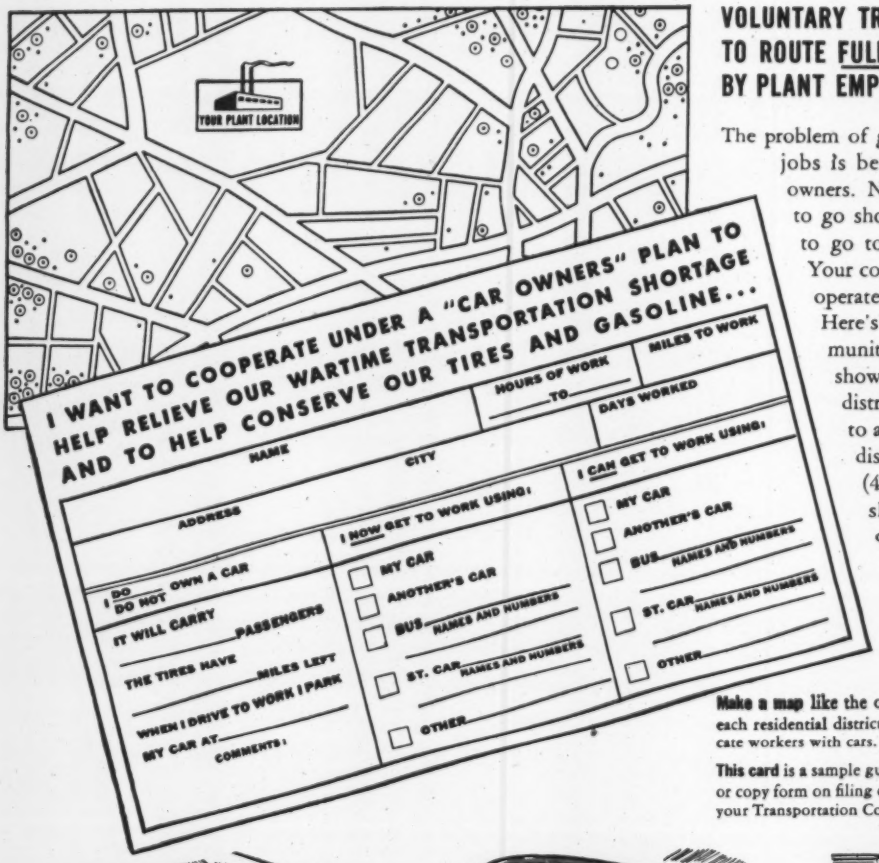
MANY LARGE COMPANIES ARE NOW TAKING A CENSUS OF EMPLOYEES' CARS AS PART OF NATION'S PROGRAM TO GET 40,000,000 WORKERS TO THEIR JOBS ON TIME


YOUR PLANT LOCATION
I WANT TO COOPERATE UNDER A "CAR OWNERS" PLAN TO HELP RELIEVE OUR WARTIME TRANSPORTATION SHORTAGE AND TO HELP CONSERVE OUR TIRES AND GASOLINE...
NAME
CITY
HOURS OF WORK
TO
MILES TO WORK
DAYS WORKED
ADDRESS
I DO / DO NOT OWN A CAR
IT WILL CARRY PASSENGERS
THE TIRES HAVE MILES LEFT
WHEN I DRIVE TO WORK I PARK MY CAR AT
COMMENTS:
I NOW GET TO WORK USING:
MY CAR
ANOTHER'S CAR
BUS NAMES AND NUMBERS
ST. CAR NAMES AND NUMBERS
OTHER
I CAN GET TO WORK USING:
MY CAR
ANOTHER'S CAR
BUS NAMES AND NUMBERS
ST. CAR NAMES AND NUMBERS
OTHER

VOLUNTARY TRANSPORTATION COMMITTEES TO ROUTE FULL CARS TO WORK ARE SET UP BY PLANT EMPLOYEES IN EACH COMMUNITY

The problem of getting 40,000,000 workers to their jobs is being taken over by America's car owners. Neighbors are already doubling up to go shopping, to take children to school, to go to work . . . *but not enough of them!* Your company and your employees can cooperate by taking a census of workers' cars. Here's how you can do it in your community: (1) Fill out cards, like the one shown here, (2) Sort cards by residential districts, (3) Select sectional committees to act as traffic control groups for each district to assure equitable use of cars, (4) Route *full* cars to work on every shift. Details can be worked out quickly by you . . . your workers . . . your community. The important thing is to start today to get every last mile of use from our cars, our gas, our tires!

Make a map like the one above, on which to chart the routes for each residential district. Dots indicate workers' homes; circles indicate workers with cars.

This card is a sample guide. Make changes to suit your needs. Reprint or copy form on filing cards for each worker to fill out and turn in to your Transportation Committee.

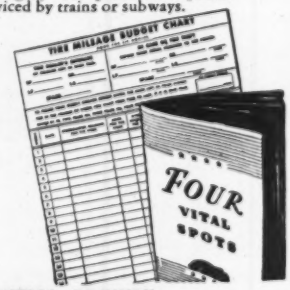
Trolleys can't do it ALONE. Even with staggered work hours to level off transportation peaks there aren't enough trolleys to take America's millions to work.

Buses can't do it ALONE. They're already taxed to their full seating capacity. And enough vital steel and rubber can't be spared to build enough new buses.

Trains can't do it ALONE. Although every railroad is cooperating 100%, many of America's mighty war production plants can't be serviced by trains or subways.

HOW TO CONSERVE MECHANICAL RUBBER GOODS
This 48-page book is for managers, engineers and plant operating men. It shows how you can conserve rubber through proper handling, installation and care of rubber conveyor, elevator and transmission belts; all types of industrial hose; packings; linings; rolls; mountings; and other mechanical rubber goods; and electrical wires, cables, and tapes. For free copies, write directly to Mechanical Goods Division, United States Rubber Company.

GET FREE MILEAGE BUDGET CHARTS
and copies of this free 32-page book on tire care from your local U. S. Tire Dealer or write direct to the United States Rubber Company. Hundreds of thousands of these charts and books are already in the hands of American car owners — helping to save tires, gas and oil.



IN AMERICA'S FIGHT FOR LIFE, EVERY TIRE-MILE MUST BE SAVED FOR ESSENTIAL DRIVING

UNITED STATES RUBBER COMPANY

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ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewers, Waterworks, Bridges, Highways, Streets, Dams, Foundations, Earthwork, Flood Control, Public Works, Irrigation, Canals, Railroads

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Vol. 128 JUNE 4, 1942 No. 23

THIS WEEK

• Three types of airport drainage systems, each designed to overcome those problems incident to a wide variety of rainfall and soil conditions, have been successfully employed by the U. S. Corps of Engineers on Texas fields. Design, construction and cost features are described on p. 66.

• Plans and construction data for an underground air-raid shelter that will accommodate fifty people, and designed to withstand the impact of 100-lb. demolition bombs appear on p. 64.

• Construction of the War Department's new office building at Arlington, Va., required the mixing and placing of 450,000 cu.yd. of concrete in over 100 acres of floor-slab forms. Features of the procedure employed included, excavation of a lagoon for water-borne delivery of aggregates, closely controlled batching to truck-mounted mixers for delivery, and placing by tower hoist and buggy. A resume of the work will be found on p. 80.

World's Largest Waterworks Project

• Chicago's South District Filtration Project—world's largest water treatment plant now nearing completion—can be examined from intake to outlet in the June 18 Annual Waterworks Number. A special section in this issue, written entirely by staff engineers of the Chicago division of water purification, tells the complete story of the conception, design and construction of this 320-mgd. project. Included also is a four-page insert in color, depicting the treatment processes. Seven articles detail the pumping arrangements, conditioning processes, filtration facilities, chemical handling equipment and instruments for operation control.

Also in this issue:

Roster of Waterworks Equipment
Air-Raid Protection for Waterworks

and a selected group of articles on highways, structural design and construction practice.

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Number of copies of this issue printed: 36,793

QUICK STEEL
IN
RYERSON STOCK

Your nearby Ryerson plant carries reinforcing bars, wire mesh, structurals, roofing... and practically every form of construction steel and allied products . . . in stock for immediate shipment.

The demands of wartime, naturally, have limited our stock, but we are in a position to furnish steel for the war program and essential industries.

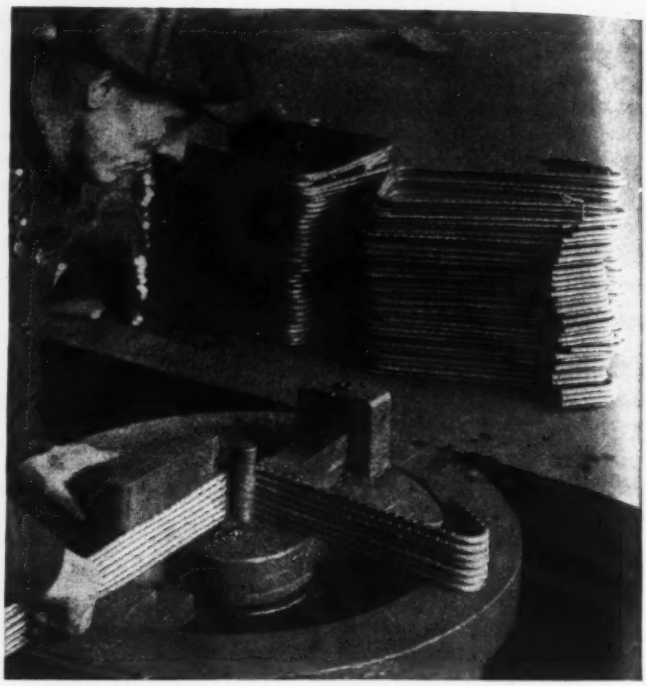
HELP FOR BUILDERS

The Ryerson Contractors & Builders Division offers a comprehensive service for planning and completing your jobs on time. Shipments of fabricated structural steel; or cut, bent and tagged reinforcing bars are scheduled to meet your actual day-to-day needs as the job progresses. Let Ryerson engineers help you with plans or problems.

New 1942 Stock List mailed on request

•

Joseph T. Ryerson & Son, Inc. Plants in: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.



Complete Facilities for cutting, bending or forming Reinforcing steels to specification.

Prompt Deliveries to meet your day-to-day job needs and keep materials coming on schedule.

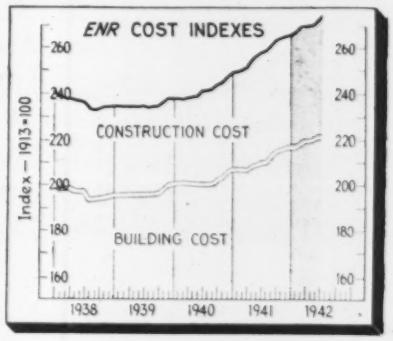
RYERSON

MONTHLY CONSTRUCTION BUSINESS SUMMARY

ENR CONSTRUCTION VOLUME AND NEW CAPITAL . . . FHA MORTGAGES

(,000 omitted)	May 1941 (5 wk.)	May 1942 (4 wk.)	% Change†	Five Months 1941 (22 wk.)	Five Months 1942 (22 wk.)	% Change
Total Construction	$409,371	$1,044,572	+219.0	$2,252,182	$3,936,356	+75.0
Private Construction	125,280	49,325	−51.0	637,159	300,761	−53.0
Public Construction	284,091	995,247	+338.0	1,615,023	3,635,595	+125.0
Federal	162,770	939,400	+621.0	1,068,520	3,348,013	+214.0
Total New Productive Capital	$223,996	$4,360,002	+2,335.0	$3,271,780	$6,818,823	+108.0
Private Investment	39,291	29,952	−5.0	328,547	232,455	−29.0
Federal (non-federal work)	12,205	16,050	+64.0	51,896	47,413	−9.0
Federal (federal work)	172,500	4,314,000	+3,030.0	2,891,337	6,538,955	+126.0
FHA Mortgages Selected for Appraisal (Title II)	$147,478	..... *	.....	$622,921	..... *	.....

†*Adjusted for difference in number of weeks.* * *Not available.*



CONSTRUCTION COSTS . . . WAGE RATES . . . PRICES

	June 1941	June 1942	% Change	1941 May	1941 June	Change May to June %	1942 May	1942 June	%
ENR Construction Cost Index, 1913 = 100‡	256.79	274.19	+6.8	255.55	256.79	+0.5	272.30	274.19	+0.7
ENR Building Cost Index, 1913 = 100‡	209.41	221.18	+5.6	209.24	209.41	+0.1	220.14	221.18	+0.5

‡*Does not reflect increased costs due to more overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$0.747	$0.796	+6.6	$0.741	$0.747	+0.8	$0.788	$0.796	+1.0
Skilled Labor (Av. 3 trades)	1.492	1.533	+4.1	1.490	1.492	+0.1	1.542	1.553	+0.7
Bricklayers	1.581	1.654	+4.6	1.569	1.581	+0.8	1.645	1.654	+0.5
Structural Ironworkers	1.569	1.612	+2.7	1.569	1.569	0	1.602	1.612	+0.6
Carpenters	1.327	1.392	+4.9	1.332	1.327	−0.4	1.379	1.392	+0.9
Cement, per bbl.	$2.52	$2.60	+3.2	$2.52	$2.52	0	$2.60	$2.60	0
Reinforcing steel, per cwt.	2.58	2.69	+4.3	2.57	2.58	+0.4	2.67	2.69	+0.7
Struct. steel shapes, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
Sand, per ton	1.17	1.19	+1.7	1.18	1.17	−0.8	1.19	1.19	0
Lumber, 2x4 Fir, per M ft.	41.18	48.43	+17.6	40.68	41.18	+1.2	48.30	48.43	+0.3
Lumber, 2x4 Pine, per M ft.	37.07	43.23	+16.6	37.49	37.07	−1.1	42.82	43.23	+1.0
Brick, common, per M	14.68	15.46	+5.3	14.55	14.68	+0.9	15.41	15.46	+0.3
Ready-mixed concrete, c.y.	6.93	7.33	+5.8	6.93	6.93	0	7.33	7.33	0
Struct. clay tile, 3x12x12	74.59	76.96	+3.2	74.49	74.59	+0.1	76.72	76.96	+0.3
Paving asphalt, cars, ton	14.43	15.00	+4.0	14.40	14.43	+0.2	14.93	15.00	+0.5

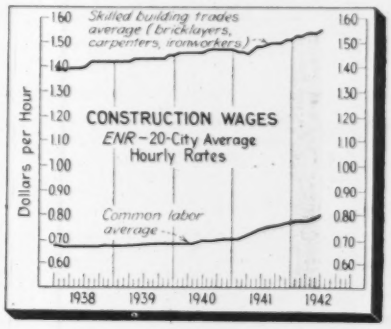
ENR INDEX NUMBERS

	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Base = 100						
June, 1942	274.19	131.80	221.18	119.56	.....	.....
May, 1942	272.30	130.89	220.14	119.00	821	360
April, 1942	271.78	130.64	219.55	118.68	569	249
Mar., 1942	269.71	129.65	218.88	118.32	578	253
Feb., 1942	269.41	129.51	218.44	118.08	507	222
Jan., 1942	267.63	128.65	217.12	117.37	402	176
Dec., 1941	266.16	127.94	216.37	116.96	217	95
Nov., 1941	266.13	127.93	216.54	117.05	282	124
Oct., 1941	264.46	127.13	215.92	116.72	263	115
Sept., 1941	263.12	126.48	214.58	116.00	419	184
Aug., 1941	260.41	125.18	212.45	114.84	434	190
July, 1941	258.18	124.11	210.22	113.64	635	278
June, 1941	256.79	123.44	209.41	113.20	492	216
May, 1941	255.55	122.84	209.24	113.11	275	121
1941 (Av.)	257.84	123.95	211.46	114.32	375	164
1940 (Av.)	241.96	116.31	202.81	109.64	269	118
1939 (Av.)	235.51	113.21	197.44	106.73	211	92
1938 (Av.)	235.86	113.34	196.83	106.40	197	86

MATERIAL SHIPMENTS . . . BUILDING PERMITS

	May 1941	May 1942	% Change	April 1942	% Change Apr.-May
Lumber (% 1935–'39 wk. seas. av.) N.L.M.A.	142.8	153.0	+7.1	147.0	+4.1
Steel (% operating capacity) A.I.S.I.	98.6	99.3	+0.7	98.2	+1.1

	April 1941	April 1942	% Change	Four Months 1941	Four Months 1942	% Change
Fabricated Structural Steel, tons, A.I.S.C.	189,751	176,894	−6.7	685,856	700,508	+2.1
Cement, thous. bbl., U. S. B. of M.	14,132	14,774	+4.5	39,487	44,745	+13.2
Building Permits, Dun & Bradstreet, (,000 omitted)	$141,672	$116,665	−17.7	$478,785	$370,300	−22.7



COST OF LIVING INDEXES AND EMPLOYMENT

	April 1941	April 1942	% Change	Mar. 1942	% Change Mar.-Apr.
Cost of Living Index, N.I.C.B.	86.9	97.1	+11.7	96.1	+1.0
Rent (Housing) Index, N.I.C.B.	87.8	91.0	+3.6	90.7	+0.3
Total Employment (est.) thous., B.L.S.	38,228	40,773	+6.6	40,392	+1.0
Construction Employment (est.) thous., B.L.S.	1,175	1,875	+5.6	1,738	+7.7

ENGINEERING CONSTRUCTION CONTRACTS——ENGINEERING NEWS-RECORD——MAY, 1942

Engineering News-Record *reports projects of the following minimum costs — waterworks, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Four Weeks — Thousands of Dollars (000 Omitted)

Public Works	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States May 1942	United States Five Months 1942	United States Five Months 1941	Canada
Waterworks	313	479	3,746	661	1,232	3,567	**9,998**	**45,462**	33,384	316
Sewerage	53	554	1,797	4,559	5,889	1,890	**14,742**	**44,424**	45,605	156
Bridges, Public	180	1,338	1,238	1,457	879	244	**5,336**	**27,272**	47,951	75
Earthwork and waterways	280	73	404	28	2,566	1,412	**4,763**	**168,086**	71,167	23
Streets and roads	152	9,252	9,222	9,371	11,789	6,562	**46,348**	**180,925**	248,692	661
Buildings, public	14,717	108,233	82,679	195,725	166,845	112,053	**680,252**	**2,505,277**	855,729	2,616
Unclassified, public	1,751	33,674	123,391	6,173	46,365	22,454	**233,808**	**664,149**	312,495	6,699
Total public	**17,446**	**153,603**	**222,477**	**217,974**	**235,565**	**148,182**	**995,247**	**3,635,595**	**1,615,023**	**10,549**
Federal government (included in above classifications)	16,310	138,852	213,727	203,472	225,795	141,244	**939,400**	**3,348,013**	1,068,520	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	**205**	5,191	.....
Buildings, industrial	2,723	2,091	3,330	6,807	1,695	2,223	**18,669**	**120,577**	274,036	5,840
Buildings, commercial	9,993	10,237	500	2,485	2,447	2,910	**28,572**	**152,870**	258,138	300
Unclassified, private	25	563	200	150	530	616	**2,084**	**27,109**	99,794	.....
Total private	**12,741**	**12,891**	**4,030**	**9,242**	**4,672**	**5,749**	**49,325**	**300,761**	637,159	6,140
Total Engineering Construction:										
May, 1942 — 4 weeks	**30,187**	**166,494**	**226,507**	**227,216**	**240,237**	**153,931**	**1,044,572**	.....	.....	**16,689**
April, 1942 — 5 weeks	57,241	126,783	149,323	200,908	141,735	222,706	**898,696**	.....	.....	20,546
May, 1941 — 5 weeks	23,359	89,199	103,237	66,773	73,466	53,337	**409,371**	.....	.....	18,593
Five Months — 1942	**156,990**	**608,807**	**891,531**	**745,336**	**846,670**	**687,022**	.....	**3,936,356**	.....	**68,955**
Five Months — 1941	131,789	545,919	436,075	446,271	387,317	304,811	.....	.....	2,252,182	80,080

MORE LIGHT FOR NIGHT DRIVING

from New Reflecting Safety Curb

These pictures of New York State Highway tell story of greater visibility and traffic safety assured by White Concrete Reflecting Curb

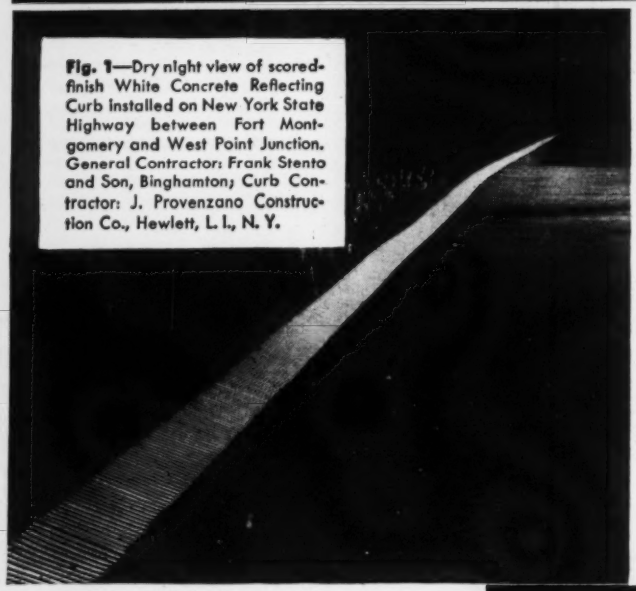


Fig. 1—Dry night view of scored-finish White Concrete Reflecting Curb installed on New York State Highway between Fort Montgomery and West Point Junction. General Contractor: Frank Stento and Son, Binghamton; Curb Contractor: J. Provenzano Construction Co., Hewlett, L. I., N. Y.

WHY White Concrete Reflecting Curb is an important contribution to safety on roads and streets is clearly shown in these two photographs.

On a dry night, under car headlights only—no other illumination—White Concrete Reflecting Curb defines the road far ahead of the car. Why? Because the white concrete is a good reflector, and because the saw-tooth faces of *reflecting* curb (as explained in Figs. 3 and 4) make the curb highly visible by reflecting the headlight rays back to—not away from—the driver.

On a rainy night, when the pavement is almost completely blacked out, *reflecting* curb provides a brighter guide to safety than on a dry night. Why? Water on the reflecting faces fills in the minor depressions in the white concrete, creating a smoother, more mirror-like surface which reflects even more light back to the driver and thus makes the curb even more highly visible.

White Concrete Reflecting Curb made with Atlas White cement has proved its efficiency and economy in many installations. Although relatively new, it has been installed or specified in 16 states.

WHY REFLECTING CURB IS HIGHLY VISIBLE

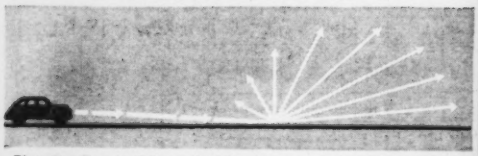


Fig. 3—For visibility of curb, *direction* of reflected light is as important as the *amount* of light. Car headlights strike *smooth* curb or pavement at a flat angle, and thus nearly all the light is wasted—it is reflected forward, in the *wrong* direction, *away* from driver. Visibility is poor, and on rainy nights is almost nil.

Fig. 4—When car headlights strike the saw-tooth faces of reflecting curb, the light is conserved—it is reflected in the *right* direction, *back* to the driver, forming a bright guide to safety. Visibility is high on dry nights and higher still on rainy nights (explained above, right).

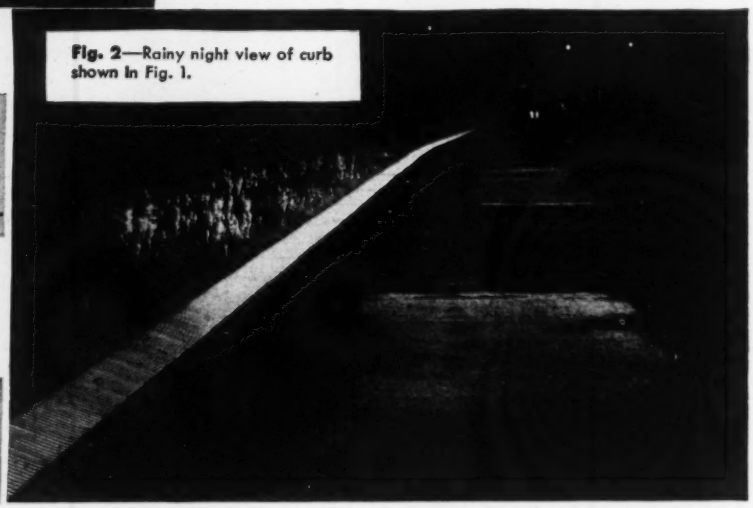


Fig. 2—Rainy night view of curb shown in Fig. 1.

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ENR-M-26

The Week In Engineering and Construction

ENGINEERING NEWS-RECORD • JUNE 4, 1942 • VOLUME 128 • NUMBER 23

Corps of Engineers abandons formal competition on bids

Construction contract practice brought into line with other war buying as emphasis is shifted away from low bidder. A-E-M contract award policy affected by shift

The Corps of Engineers, which does all construction for the War Department, has abandoned open competitive bidding as the normal method of awarding its contracts.

Ever since 1940, the Corps has had authority to award contracts by negotiation. Most of the larger contracts have been let regularly in this manner, but the view has always persisted that open competition—with award to the lowest responsible bidder—was the normal and most desirable way of letting contracts.

The new policy, in effect, recognizes that under war conditions formal competitive bidding is not even desirable—that many other factors are more important than price. Special permission must now be obtained from the War Production Board before formal advertisement and competitive bidding are resorted to.

The essentials of competition are to be preserved under the new policy on all fixed price jobs—lump sum or unit price. Informal bids will be solicited. But these will generally be by invitation to contractors who have qualified themselves for such invitation by submitting their records to the Corps of Engineers. Additionally, receipt of bids will often be followed by a certain amount of negotiation, and firms interested in the job may be argued into reducing their bids.

Other considerations

Nor will the job always or necessarily go to the low bidder. Other considerations to be taken into account include:

Speed of doing the work.

Placing of simple jobs with smaller concerns so as to conserve the facilities of the big outfits for the tough jobs.

Placing work with firms which need the least additional equipment. Henceforth, in the negotiation of any contract, prospective contractors will be required to list all the additional equipment they expect to use.

Conservation of transportation. Firms which are in a position to do the work using transportation facilities to a minimum will be given preference.

A-E-M policy affected

Particularly affected by the changed policy will be the new Architect-Engineer-Manager contracts (*ENR* Feb. 19, p. 297) being used on large jobs. The A-E-M contract itself has always been let by negotiation, but it has been customary to award the sub-contracts by open bidding. In future these sub-contracts will be on a negotiated fixed-price basis.

The new policy does not change the Corps of Engineers' decentralized system of contract award. Engineer field offices are permitted to negotiate contracts or change orders involving sums up to $5,000,000.

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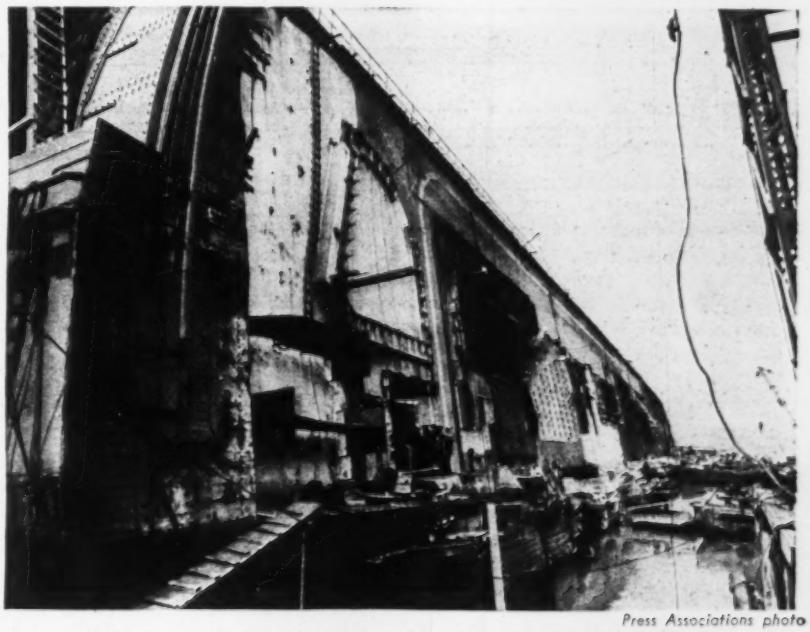
Congress asked for new war housing funds

President Roosevelt has asked Congress to appropriate an additional $600,000,000 for construction of war housing. If approved, this will bring the total so far appropriated for the purpose to $1,620,000,000. The request comes at a time when there is serious doubt whether anything like enough materials will be available to permit carrying on any sort of a housing program. However, the President emphasized that housing shortages are already threatening to endanger war output and said that an estimated 1,600,000 workers will move to centers of war industry in the year starting next July.



Press Associations photo

Salvage operations proceed on capsized liner

Its three upper decks shorn away by wreckers who literally "cleared the decks" for salvage operations, the former French liner "Normandie" is a strange, forlorn sight at its pier in New York harbor.

The steamship, being converted into a military transport, burned and capsized Feb. 10.

In a report on salvage possibilities issued last week (ENR, May 28, p. 880) the Navy Department said it would refloat the ship by means of controlled pumping, and that the work would be started "as soon as possible."

WASHINGTON HIGHLIGHTS

APPROPRIATION for the Bureau of Reclamation was increased $12,000,000 by the Senate over the House approved figure to a total of $89,000,000. Major increase was $4,178,000 for California's Central Valley Project. This includes $3,723,000 for construction of transmission lines, $200,000 for engineering studies on the Antioch steam plant, actual construction of which was eliminated by Congress, and funds for irrigation works to develop lands for the growing of guayule, a rubber substitute. An additional $2,170,000 was provided to hasten power generation at the Colorado-Big Thompson Project.

UNIFORM truck-weight rules have been approved by governors of all the states, meeting under the auspices of the Council of State Governments. The standard rules of the Public Roads Administration, based on an 18,000-lb. axle load, will be put into effect by the governors under their emergency powers without need for further legislation. They have also agreed to recognize license plates of every state as regards trucks carrying war goods.

RESTRICTIONS imposed last April on the sale of plumbing equipment except on priority ratings have been partially lifted by amendment of WPB order L-79. Orders for plumbing and heating equipment placed before April 16 may be filled. Equipment may be delivered without a priority rating to complete any project started before April 9 or approved by WPB under the terms of the construction order, L-41. Meanwhile, WPB continues its program of simplifying plumbing design by forbidding the use of metal in manufacture of sinks and water closets.

FUNDS asked for WPA for the fiscal year starting next July have been reduced by the President to $282,767,000. He had previously asked for $465,000,000.

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Marine Corps seeks engineering officers

The U. S. Marine Corps last week asked the aid of engineering soc'eties in locating qualified young civil engineers for commissions and active duty in the engineering organizations of the Corps. Candidates should have a minimum of two years of practical field experience after graduation from school.

Inquiries may be directed to Maj. George E. Tomlinson, U.S.M.C., 3107 Arlington Annex, Arlington, Va.

Flow of river under Hale's Bar Dam reduced

The flow of the Tennessee River under Hale's Bar Dam—at one time about 1,700 cfs.—has been substantially reduced by calyx core drilling of 18-in. diameter holes some 60 ft. below rock surface at the dam, and filling the holes with concrete. More than 200 holes, 12,000 lineal feet of drilling, have been completed and filled. A considerable reduction in flow is indicated by the disappearance of part of the water-boils below the dam.

Construction procedure is to drill a series of holes and remove the cores, then line the holes with asbestos cement pipe, filling the holes with concrete to form a continuous cut-off wall across the upstream face of the dam (ENR Nov. 6, p. 654). Several four-speed electric power drills are used for this operation.

Three advances in the drilling art have recently been made: By careful rationing, shot was reduced from 25 lb. to 10 ft. per foot of holes drilled and the rate of drilling increased; a better method of plumbing the 60 ft. casings under water was provided by a device built on the job, and the breaking of box-and-pin-type tool joints was eliminated by use of heavy oil-field-type tongs.

Pittsburgh carpenters end one-day strike

Strikes by Pittsburgh, Pa., carpenters which last week threatened to cripple four war construction projects were ended in one day, when the men agreed to return to their jobs pending adjustment of their wage dispute by the Labor Department's newly-organized Wage Adjustment Board (*ENR* May 28, p. 879).

Jobs struck in the short-lived walkout included two housing projects and two projects involving additions to plants.

The dispute apparently arose through uncertainty over interpretation of the Federal Government's latest moves toward wage stabilization. Some months ago the carpenters, negotiating with the Master Builder's Association of Allegheny County, agreed on a pay-rate of $1.75 per hour. However, the Department of Labor certified rates of $1.50 per hour for the Pittsburgh area.

Canadian provinces agree on power development

The province of Quebec and Ontario have agreed to develop jointly additional power facilities on the Ottawa River, main tributary of the St. Lawrence after negotiations completed last week (*ENR* May 28, p. 891).

Under terms of an agreement reached between T. H. Hogg, chairman and chief engineer of the Hydro-Electric Power Commission of Ontario, and the Quebec government, Ontario is to have development rights on the upper Ottawa in the Des Joachims area near the western limit of Pontiac County. Included with the Des Joachims rights are the Cave and Fourneaux and Chenaux power sites, and half the fall at Paquette. Under similar lease conditions, to be granted to the Quebec Streams Commission, Ontario's rights at Rocher Fendu and Carillon, on the lower river, will go to Quebec.

WPB installs contract code system as check on final use of raw materials

Twenty-three classifications set up for inclusion on orders placed with suppliers will indicate disposition of materials ordered

As an aid to close and careful allocation of raw materials, the War Production Board is installing a system of identifying code numbers which must be attached to all orders placed by producers—including construction firms—after June 30. Effective at once, all orders that call for delivery after July 31 must also be coded. The code numbers indicate the ultimate use to which the material being bought will be put.

Code classifications

There are 23 code classifications and each of these is in turn sub-divided decimally:

1.00, aircraft; 2.00, ships; 3.00, military vehicles; 4.00, armament and weapons; 5.00, ammunition; 6.00, war equipment and supplies; 7.00, war facilities (7.10, airfields, camps, bases, etc. in continental U.S.; 7.20, the same outside the U.S.; 7.30, government owned munitions plants; 7.40, Panama Canal; 7.50, government-owned shipyards); 8.00, raw materials production; 9.00, power, light, and heat; 10.00, transportation (10.10, railroad; 10.20, automotive; 10.30, roads; 10.40, water, including private shipyards; 10.50, air; 10.90, other); 11.00, communication; 12.00, public health and safety; 13.00, agricultural equipment; 14.00, food processing; 15.00, wearing apparel; 16.00, household equipment; 17.00, education and information; 18.00, recreation; 19.00, office equipment; 20.00, industrial equipment; 21.00, buildings (21.10, industrial and commercial buildings; 21.20 dwellings; 21.90, other buildings); 22.00 operating supplies; 23.00, other end uses.

Thus, a contractor buying reinforcing steel for a highway job would attach the number 10.20 to his order, indicating it will be used for highway transportation. If, on the other hand, the reinforcing bars were to go into a sewage treatment plant, he would code his order 12.00, sanitary systems. If he were placing one order for steel for both jobs, he might code it 60 percent 10.20, 40 percent 12.10.

These code numbers will stay with the order as it moves from supplier to supplier toward the ultimate raw material producer. Finally, the steel mill (in the above example), will have a very complete picture of the final uses of the steel it sells. WPB's steel branch will use this information in allocating the metal.

The code numbers have another part, identifying the type of purchaser. These are: USA, army; USN, navy and maritime commission; LL, lend-lease; FP, other foreign purchasers; DP, other domestic purchasers. Thus the hypothetical order for reinforcing bars might actually be coded: DP—60 percent 10.20; 40 percent 12.10.

The situation as regards buildings is unusual. A contractor buying goods in connection with construction of a building will code all such purchases 22, regardless of the use to which the building will be put. The only exception is military buildings, which are coded 7.

Any other type of construction is coded in accordance with the use to which the structure will be put. Every order must be coded, whether it is for materials to go into the structure or operating supplies for the contractor.

Grand River Authority buys utilities' power

To make more power available for war industry in Oklahoma, and reversing the terms of a contract signed 15 months ago, the Grand River Dam Authority recently signed a contract with two Oklahoma utilities to purchase steam-generated electric current.

Under the new contract, the steam-generated power of the Public Service Company of Oklahoma and the Oklahoma Gas & Electric Company will be sold to the Authority between the hours of 9 p.m. and 8 a.m., to permit the hydro plant to shut down its turbines during those hours for water storage. The two private companies will buy current from the Authority during the off peak hours, from 8 a.m. to 9 p.m.

When the Authority began operation more than 15 months ago, the current was sold to the Oklahoma Gas & Electric Co. Officials said that the new contract makes a power pool available over a network of lines extending over portions of Kansas, Oklahoma and Arkansas.

Highway bridge jacked up to new position

To permit unobstructed flow of water in a dam basin, this steel highway bridge two miles north of Dover, Ohio, was jacked to a height of 17 ft. above its original level.

The bridge was built in 1929, and consists of three 105 ft. steel low truss spans, carrying a 24-ft. concrete roadway and 2-ft. 6 in. sidewalks. Relocation was necessary to accommodate water backed up by Dover Dam, one of the numerous dams recently built by the U. S. Corps of Engineers. The relocation project also calls for grading and building 4½ miles of new 24-ft. concrete road.

Old piers and abutments were used as curtain walls for the new piers, the ends being enlarged in octagonal shape directly beneath the truss supports. Steel H-beam piling was driven to support the octagonal pier ends, and the new foundations and shafts were then poured to the existing pier height. Steel brackets were welded to the ends of trusses for the hydraulic lifting jacks, and temporary timber cribbing for supporting the jacks was placed as the lifting operation proceeded. A steel grillage system, used to support the bridge during the lifting process, was encased in concrete to form the upper part of the pier shaft.

Once preliminary work was completed, actual raising was accomplished at the rate of about 10 in. per day.

The Frank Mashuda Company, of Milwaukee, Wis., held a general contract for the entire job, subletting the raising of the bridge to the Purdy Construction Company, of Mansfield, Ohio. E. R. McCullough, Ohio Department of Highways division engineer at New Philadelphia, and his staff supervised the work.

WPB orders new plant building held to essential war needs, simple design

Nelson's directive puts no time limit on completing construction, stresses temporary design. Labor shortage seen despite plant cut

The War Production Board's new policy of holding down further construction of munitions plants (*ENR*, May 21, p. 51) has been incorporated in a formal directive signed by WPB's Donald Nelson and the secretaries of War and Navy departments. As forecast in these pages, the directive imposes no arbitrary rule as to when plants must be completed. It simply sets a general policy that any new project must be absolutely essential to the war, so essential that it cannot be deferred without injuring the war effort. It must be such as not to duplicate any existing facility, and there must be assurance that materials and manpower will be available for its operation. There must be immediate use or storage capacity for the plant's product. In other words, no plant should be built just because it would be a nice thing to have in an emergency.

The directive also lays great stress on the use of simple, temporary designs. "All construction," it says, "shall be of the cheapest temporary character with structural stability only sufficient to meet the needs of the service it is intended to fulfill during the period of its contemplated war use." . . . Wood frame construction is preferable to reinforced concrete, and reinforced concrete is preferred to steel. . . .

"Mechanical and electrical features shall be reduced to bare essentials. Air conditioning may be used only where manufacturing processes make its use essential. . . ."

The directive is drafted primarily in terms of plant construction, but it is made clear that the same principles are to apply to all construction, public and private.

Severe Labor Shortage Seen

Serious local shortages of construction labor late this summer are anticipated by the Social Security Board. Estimates indicated that in the peak month of September some 500,000 more men will be required than were employed last March, at which time the supply was a little bit more than adequate. These estimates were made before the "no more plants" rule was adopted, but this does not entirely invalidate the estimates.

Raid injuries in private shelter not owner's loss

Property owners whose buildings are used as public air raid shelters are not responsible for injuries to the public, according to an opinion rendered last week by the California state attorney-general.

The American Municipal Association said the question arose when owners of buildings designated as air raid shelters sought immunity from suit in the event personal injury is suffered by the public when entering, using or leaving the shelter.

The attorney general's opinion said that the property owner furthers no interest of his own in allowing his property to be designated as a shelter, and that the public uses the shelters as "gratuitous licensees," therefore the owner cannot be held liable for injury caused by a defect of the premises. However, the owner or occupant must give proper warning of any known dangers on the property.

Though the cities and defense councils are responsible for the proper selection of shelter sites, they would not be liable for injuries suffered in the shelters because they have no control over the designated property, the opinion added.

May construction total tops billion for record

Heavy engineering totals compiled for May, 1942 by *Engineering News-Record* reached a new all-time high of $1,044,572,000. The figure represented an average of $261,143,000 per week—a 37 percent increase over the previous peak (July, 1941), 45 percent above April, 1942, and 219 percent above May, 1941.

Over 95 percent of the May construction was public work, another all-time high. Private engineering, however, was three percent under the figure for April, 1942, and 51 percent under May, 1941.

The total—first billion-dollar month in the history of engineering construction—brought volume for the first five months of 1942 to $3,936,336,000, almost equal to the total for the entire year of 1940.

Just over 85 percent of the volume, $3,348,013,000, was federally financed construction, 214 percent above the record for the same five month period a year ago. State and municipal work totalled $287,582,000—a 47 percent drop under last year, and private engineering construction was $300,761,000—a drop of 53 percent from the preceding year. All geographical sections of the United States participated in the increase.

Studies made to convert Chicago's fixed bridges

Plans are under consideration for conversion of 16 fixed bridges over the South Branch of the Chicago River, and over the city drainage canal to movable spans to permit operation of larger vessels between the Great Lakes and the Gulf via the Illinois waterway and the Mississippi River.

Though the Corps of Engineers is conducting hearings and investigations, pressure for the conversion is being exerted by the Navy with an eye to building of large boats in the lakes and routing them to saltwater down the Mississippi.

All of the structures being considered now provide 22-ft. vertical clearance for barge and collapsible-stack towboat traffic. Most of the bridges were designed with movable spans, but operating machinery and power were never installed, and there is some question as to how much strengthening and rebuilding several older spans will need to make them workable.

Seven of the structures are railroad spans, including the famous quadruple bascule of four double-track single leafs just west of Western Ave. The other six rail crossing are all swing spans, equipped with racks but no power. Five highway bridges further out are owned by the Sanitary District, and all need operating machinery.

One of four city-owned or maintained bridges—that at Western Ave.—is the biggest problem. This structure was built as a fixed bridge, with a center truss span suspended from cantilevers. Plans are being drawn to build towers at the river ends of the cantilevers and convert the suspended center span to a vertical lift with 39 ft. clearance over the river and a 100-ft. wide opening. The War Department has not yet approved this scheme.

Altering three other city bridges, all bascules, also brings up the question of responsibility. They were built by the Sanitary District, which turned them over to the city for operation and maintenance upon completion. The city contends that since the bridges have always lacked operating machinery, they were never actually completed, but the city has maintained them anyway. In view of this record, the corporation counsel has ruled the city may expend funds to make them movable. Allocating of $500,000 for Western Ave., and a total of $145,000 for the other three have been made. State approval of this arrangement is awaited.

Financing arrangements have not as yet been completed for converting the Sanitary District and railroad bridges. Some federal funds are being sought on the ground that the project is a war measure.

Davis Dam contract let to Utah Construction Co.

The Utah Construction Company of San Francisco, Calif., has been awarded the first major contract on construction of Davis Dam, near Kingman, Ariz., on a bid of $18,996,392.

Davis Dam Constructors, Los Angeles, Calif., only other bidder, submitted a bid of $19,313,434.

Bids were opened May 15 and the award announced June 1 by the U. S. Bureau of Reclamation's office at Kingman, Ariz., near where the $40,000,000 dam will be constructed.

The dam (*ENR*, April 23, p. 600 and previous) is to be built on the Colorado River about 30 miles west of Kingman, 67 miles below Boulder Dam. The structure will be a rock and earth fill dam, 200 ft. high, with a reservoir having a total capacity of 1,800,000 acre-feet. The power house will contain five 45,000 kva. generator units. Construction will require moving about 10,000,000 cu.yd. of earth and 2,200,000 cu.yd. of rock and calls for the placing of 450,000 cu.yd. of concrete.

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Malheur dam gate repair costs revised upward

First reports to the Bureau of Reclamation concerning flood damage to the gates of Agency Valley Dam on the Malheur River in Oregon (*ENR* May 14, 1942, p. 814) underestimated the damage that a later inspection revealed, according to S. O. Harper, chief engineer of the Bureau. Instead of repairing the gates in place at the cost of a few hundred dollars as was first thought possible they must be removed and shipped to a well-equipped shop, where the repair charges incident to straightening and rebuilding the bent structural members will amount to several thousand dollars.

Of the three radial gates on the spillway, two were dislodged when an anchor bolt failed under a reservoir level that the gate tender had permitted to rise a foot or more above the top of the gates. Although not an approved practice, this high reservoir level had apparently been allowed occasionally in order to conserve the maximum quantity of water during recent drought periods. Mr. Harper said it is not believed, however, that this condition contributed in any important degree to the failure, which was evidently due to a latent defect in the anchor bolt, which even under the excess head was said to have a theoretical safety factor of over 4.

A recheck of the spillway discharge at the time of the failure places the maximum outflow through the gate openings at 2,500 sec.ft. instead of the 1,500 first estimated.

FWA takes over North Carolina power job when injunction stops city's work

Yadkin River project near High Point, N. C., becomes federal work after state courts enjoin city from carrying out construction

In a move to circumvent legal obstacles which have for three years prevented the city of High Point, N. C., from building a hydro-electric project near it on the Yadkin River, the Federal Works Agency has taken over the project and is planning to build it as a federal job.

High Point had planned to do the work by means of an $8.000.000 PWA grant and loan. Local power companies, however, obtained an injunction from the North Carolina Supreme Court on the grounds that the city had no authority to carry out the project—particularly because it had not obtained a certificate of convenience and necessity from the state.

The President has authorized direct federal use of the $8,000,000 previously granted.

The federal agency is not affected by the injunction and approval of the project has been granted by the Federal Power Commission. Still in doubt, however, is the attitude of the War Production Board. This is crucial, since unless WPB approves no priorities will be forthcoming and the project cannot be built.

In announcing that the government would take over the completion of the dam and reservoir, the FWA said the step was deemed necessary "in order to relieve a power shortage for war work in the area," and that in ordering its completion President Roosevelt acted under the War Powers Act and the Public Works Appropriation Act of 1938.

Kenneth Markwell, PWA project engineer for the Santee-Cooper project in South Carolina, has been appointed project engineer for the work, and Ward D. Carpenter, assistant engineer on the Santee-Cooper project, already has begun arranging for office space at Winston-Salem, N. C., for use by engineers, lawyers, abstractors, typists and clerical help needed for obtaining land titles and clearing obstructions to the project. W. Meade Keller, FWA counsel at Charleston, S. C., has been named project attorney.

The project will be "redesigned to meet wartime conditions," and work is scheduled to get under way as soon as possible, it was announced. The work of adjusting existing contracts and obtaining land titles is to begin immediately.

High Point received its first federal grant for the project in November 1936 and the original plans called for completion of the project within 14 months. However, litigation involving the project has been to the North Carolina Supreme Court four times, the last decision keeping work on the project at a halt being rendered in February 1941. Since that time city officials have been seeking ways and means of completing the project.

It is estimated that about $300,000 was spent by contractors on the project before the work was halted, and several suits filed against the city of High Point by contractors now are pending in federal court.

Under revised plans, the project also will include an auxiliary steam plant.

Second town seeks similar aid

Spurred by the announced decision of the FWA to take over the Yadkin project at High Point, the city of North Wilkesboro, N. C., further upstream, planned to send a delegation to Washington soon to urge federal construction of a flood control and power dam there. Proponents of the project contend that the Wilkesboro dam would serve as a feeder to the Yadkin project as well as prevent recurrence of recent damaging floods.

FWA organizes nine regional offices

The Federal Works Agency is setting up nine regional offices as part of its effort to decentralize activities to the maximum possible (*ENR*, Mar. 5, p. 365).

These permanent regional offices displace the temporary regional set-up which FWA has had in effect for some months. Exact degree of authority to be assigned to the regional offices has not yet been determined. Intention however, apparently is to push everything short of policy determinations out into the regions.

It is intended also to give the regional directors considerable authority over the activities in their regions of the FWA component agencies—PWA, WPA, PBA, and PRA. However, the precise relationships between the regions and the agencies are still hazy.

Regional directors so far appointed are: James A. McConnell, Boston; John M. Gallagher, New York; Kenneth Markwell, Richmond; James W. Bradner, Jr., Fort Worth; Pierce Williams, San Francisco; L. R. Durkee, Seattle. Still to be named are directors at Atlanta, Chicago, and Kansas City.

Rufe B. Newman has been made a special assistant to Administrator Fleming, in charge of the regional set-up.

Gas curtailment shows in falling highway revenues

Effect of general rationing of gasoline to private users on the eastern seaboard began to show last week as state financial departments totaled tax receipts for the year's first quarter.

Carroll E. Mealey, president of the New York State Tax Commission, said that motorists in the state used 18,000,000 fewer gallons of gasoline during the quarter than in the same quarter in 1941. The decline caused a drop of about $720,000 in receipts from motor fuel tax.

New Jersey State Tax Commissioner William D. Kelly estimated that rationing would result in a drop of about $6,175,000 in his state's motor fuel tax receipts. Commissioner Kelly said he based his report on figures which indicate a decrease of 20 percent during the first half of 1942, and a drop of 30 percent during the last six months of the year.

Although no figures were as yet available on actual cash losses, the North Carolina Highway and Public Works Commission said its "magic eye" counters on eleven roads throughout the state indicate that highway traffic is nearly 50 percent below last year. And in Pennsylvania, W. Purves Taylor, secretary of the Associated Petroleum Industries of Pennsylvania, warned that gasoline rationing and the shortage of rubber will materially lower the Commonwealth's income from taxes and fees and may even place the state highway system in jeopardy.

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Building officials discuss bomb protection measures

Best methods for protecting large buildings in congested areas against damage in air-raids, and safest practice in demolishing buildings damaged in such an attack formed the theme of a 4-day meeting held recently at Pittsburgh by the Building Officials Conference of America.

Several hundred men, representing municipalities, and contractors' and engineering associations attended the session.

V. G. Iden, secretary of the American Institute of Steel Construction told the group that three years of war experience in Europe has proved that steel bridges and steel-framed buildings have provided the greatest degree of safety against modern warfare. He added that all steel bridges in London are still functioning, and said that skyscraper structures seem to be "one of the safest places in the world to be" during an air attack.

In discussion of safe demolition methods, it was said that this work as practiced overseas indicate three necessary steps. These are: first, inspection of foundations of the partially wrecked building to determine disturbed or weakened parts; second, inspection to determine the capacity of the remaining structure to absorb load imposed by razing operations; and third, tearing out exposed structural members and distributing the resulting impact by the use of snub lines.

Another factor considered by the group was the problem of war housing. Howard P. Vermilya, director of the technical division, Federal Housing Authority, stressed the relation of building regulations to private wartime housing. He urged contractors and building officials to push enactment of legislation necessary to permit substitutes to be used for temporary housing construction.

"Such legislation should not be an excuse for shoddy construction, but rather a municipality must learn to use less materials and less labor in construction," Mr. Vermilya said.

In the future, although the demand for materials and labor may restrict permanent housing development, no need exists now to lower standards for permanent dwellings below the minimum and safety level.

Every engineer, architect, builder and owner can aid the conservation program by devising methods for essential construction that use minimum amounts of critical materials, C. M. Stegner, commissioner of buildings at Cincinnati said. He added that the program of conservation of critical materials is no longer one of determining the best engineering design at least cost, but rather the use of readily available substitute material with low service values, regardless of cost.

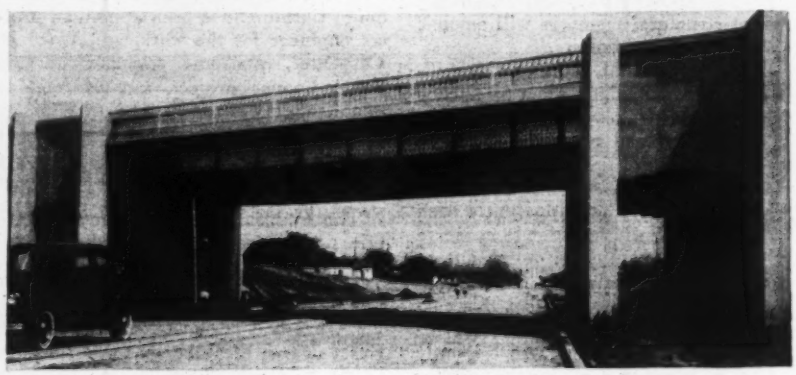
Thousand attend National Planning Conference meet

More than 1,000 persons attended sessions of the National Conference on Planning at Indianapolis, Ind., May 25-27, to discuss war and postwar planning of American communities and life. The conference is sponsored by the American Institute of Planners, the American Society of Planning Officials, the American Planning & Civic Association, and the National Planning Association.

The group heard round-table discussions on the impact of the war; industrial location and conversion, and making the best use of man-power; planning problems of the small community; planning problems of the large community and zoning. Subjects such as the abatement of stream pollution and providing for the immediate future of aviation—not usually included in the planning conference programs—were a part of the schedule.

One of the chief worries of many cities, as expressed by their representatives at the meeting, appeared to be attempts to break down zoning restrictions under the guise of aiding the war effort. All members were urged to analyze these moves toward changes in the zoning laws in an attempt to determine whether such changes has real purpose or whether they were simply an attempt to gain privileges in the name of victory which could not be obtained under ordinary circumstances.

At the annual meeting of the American Society of Planning Officials, Philip H. Elwood, head of the department of landscape architecture at Iowa State College, was elected president; and at the annual meeting of the American Planning and Civic Association, Horace M. Albright was re-elected president.



Mississippi highway relocation project completed

This underpass near Jackson, Miss., was completed recently as the final link in a relocation program which carries traffic on State Route 80 around Jackson's business district.

The underpass takes the route under a double track main line of the Illinois Central Railroad. The bridge superstructure consists of through plate girders and provides a 46 ft. clear span.

The W. G. Cook Construction Co., of Jackson, was contractor, and R. L. Priester was project engineer for the Mississippi State Highway Department.

OBITUARY

Edwin K. Morse, 85, Pittsburgh consulting engineer, civic leader and pioneer in the movement to establish a system of flood-impounding reservoirs to protect the city's industrial area against flood threats, died May 28. He had been chairman of the first Pittsburgh Flood Commission.

Albert M. Blodgett, 86, retired bridge engineer of Kansas City, Mo., who built the twelve-mile-long causeway at Galveston, Tex., and other structures, died May 28.

William C. Lancaster, 43, formerly district engineer at Wynn, Ark., for the Arkansas Highway Commission, died in Shreveport, La., May 24.

William E. Freeman, 61, assistant dean of the University of Kentucky's college of engineering since 1922, died May 21 at Lexington.

Walter H. deMets, 37, an engineer of Germantown, Pa., died May 25.

John Morgan Empey, Perth County, Ont., engineer for thirteen years until his recent retirement, died May 20 at Mitchell, Ont.

A. Rutgers Livingston, civil engineer of Homestead, Fla., died May 22. He was a former city engineer of Homestead.

Carl L. Rimmele, 52, investigations engineer for Los Angeles County Flood Control District, died May 21.

Donald F. McDonald, consulting geologist for the Panama Canal, died May 29 at his home in Balboa, C. Z. He was 66. He came to Panama in 1911 as geologist during construction of the Canal.

New York opens final link in East River Drive

With Mayor F. H. LaGuardia cutting the tape, the final section of New York's 7½ mile, $46,000,000 East River Drive was opened to traffic last week.

The section, which comprised one of the most difficult construction problems of the entire roadway, extends from 34th to 49th Sts., and its opening makes it possible to drive without interruption from Montgomery St., on the lower East Side, to the entrance to the Triborough Bridge at 125th St., in Harlem.

Extension of the drive from 125th St. to the northern tip of Manhattan Island is planned as a post war project.

CONTRACTS AND CAPITAL

ENGINEERING CONSTRUCTION VOLUME for the week totals $274,971,000, the second highest value reported for the current year, and the third highest on record. The near-record volume is 68 percent higher than last week, and 108 percent above the volume for the corresponding 1941 week. Public construction reaches the third highest peak ever attained, and is 64 and 161 percent higher, respectively, than a week ago and a year ago. Private work gains 190 percent over the preceding week, but is 52 percent below the week a year ago.

The current week's construction brings the 1942 total to $4,211,327,000, an increase of 77 percent over the volume for the corresponding 23-week period in 1941. Private construction, $316,612,000, is 53 percent under last year, but public construction is 127 percent higher as a result of the 222 percent increase in federal work.

In the classified construction groups, gains over last week are in waterworks, sewerage, industrial, commercial and public buildings, earthwork and drainage, and streets and roads. Increases over the 1941 week are in waterworks, sewerage, industrial and public buildings, and earthwork and drainage.

New capital for construction purposes for the week, $4,484,000, is 58 percent below the total for the week last year. The current week's new financing is made up of $4,478,000 in state and municipal bonds, and $6,000 in RFC loans.

New construction financing for the year to date totals $6,823,307,000, a gain of 108 percent over the $3,282,484,000 reported for the 23-week period last year.

CONTRACTS

(Thousands of dollars)

	Week Ending June 5 1941	May 28 1942	June 4 1942
Federal	$47,398	$145,433	$248,611
State & Municipal	52,000	12,336	10,509
Total public	$99,398	$157,769	$259,120
Total private	33,172	5,458	15,851
TOTALS	$132,570	$163,227	$274,971
Cumulative 1942 (23 weeks)			$4,211,327
Cumulative 1941 (23 weeks)			$2,384,782

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1941 23 weeks	1942 23 weeks
NON-FEDERAL	$391,147	$284,352
Corp. Securities	114,258	90,416
State & Mun.	224,546	146,517
U.S.H.A. loans	22,550	
R.F.C. loans	29,793	47,419
FEDERAL	$2,891,337	$6,538,955
TOTAL CAPITAL	$3,282,484	$6,823,307

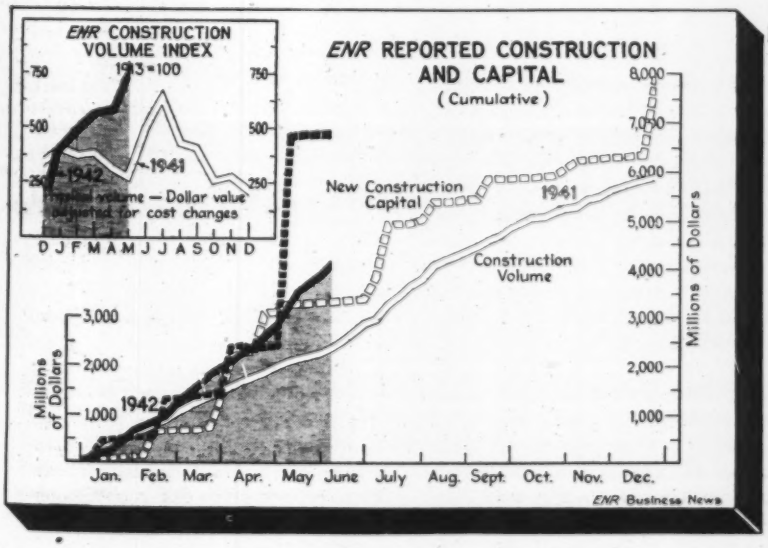
ENR INDEX NUMBERS

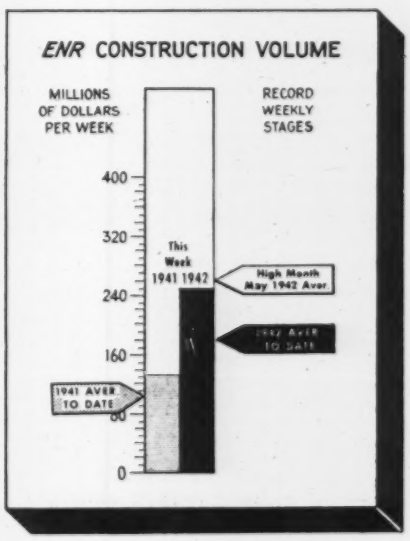
Index Base = 100		1913	1926
Construction Cost	June '42	274.19	131.80
Building Cost	June '42	221.18	119.56
Volume	May '42	821	360

FHA MORTGAGES

	Week Ending May 31 1941	May 23 1942	May 30 1942
Selected for appraisal			
Title II	$28,803	$13,079	$12,798*
Title VI	$ 3,702	$ 9,537	$ 8,693*

* Subject to revision.


ENR CONSTRUCTION VOLUME INDEX
1913=100
1942
1941
Physical volume — Dollar value adjusted for cost changes
D J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
(Cumulative)
New Construction Capital
1941
Construction Volume
1942
Millions of Dollars
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
ENR Business News



Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Air-Raid Protection

[The following extracts from a letter to Thorndike Saville, dean, College of Engineering, New York University, is reproduced with his permission because of their wide interest. The letter was written by Arthur R. Keller, vice president of the University of Hawaii. Articles referred to are the recent ones in *Engineering News-Record* relating to civil air-raid protection.—EDITORS.]

To one who has lived five months in a city that has had difficulties, to one who has been in the midst of evacuation problems, planning splinter resisting trenches and similar jobs that arise in the theatre of operations, to one who has actually been through an air raid, these articles are of great interest. I wrote to Mr. Binger, national vice chairman of the A.S.C.E. committee, the other day and emphasized the necessity of planning, preparing, and building *NOW*.

At the University of Hawaii, trenches zig-zag across the open campus spaces. You might tell your class that on the blackboard in each classroom this sentence is written "The students in this room are assigned to trench No. —." Every trench on the campus has a number and at the entrance is a sign with number and capacity. Each class has a leader who conducts the group to the allotted place. How would your class in ——— react to the following: The lecture is progressing and then the sirens blow. The lecturer stops, class arise, sling gas masks and out of the room they walk. They proceed and enter the allotted trench. If all is quiet, the discussion may proceed in the new environment. Then the all clear and back to the class room or on to another class. The remarkable part is that all is quiet, no confusion. Such is carrying on a university in the theatre of operations.

As a temporary protection, the open trench will answer but covered shelter trenches for 20 to 40 should be available, and NOW is the TIME to START. These require material, so construction should be completed before material is "frozen." We have had to exercise ingenuity in building some of our trenches. I fear the censor will not permit me to describe in detail. A shelter trench to hold 35 is nearing completion just across from my office. I know your structural design class would criticize this as far from a "one hoss shay" some members too strong, others much too weak, but we hope it stands for the duration.

Asphalt Cutoff Walls

Sir: I have noted with great interest the article by H. S. Slocum in your March 26 issue, on the use of an asphaltic mix for a dam cutoff wall at Claytor Dam. Perhaps the most surprising feature is that such construction has not been used more already. However, the use of a new material, or a new application of an old one, often suffers detriment when applied too optimistically by engineers who may be unfamiliar with the principles governing its action.

From the description of the mix used at Claytor Dam, which was prescribed by experienced asphalt engineers, no exception can be taken to the methods described. However, one encounters frequent misunderstandings of the nature of asphalt mixes, some of which might be very detrimental if found governing such work.

For instance, most normal road paving mixes would be unsatisfactory because they would not be impermeable, although many people assume that they are. The securing of impermeability with a given aggregate is often not simple; it may be accomplished either by a dense grading combined with a relatively low asphalt content, in which case the mix offers relatively high resistance to being forced into small orifices; or it may be accomplished by a fairly open graded aggregate in which the voids are filled or over-filled with asphalt. The latter type tends to be quite plastic and easily deformable, and rather corresponds to the mix described in the article. With the soft asphalt used, such a mix would conform to almost any earth movements that might be anticipated, even at normal temperatures, and would hardly need steam pipes, as suggested in your editorial comment, to cause it to conform to the contours of the enclosing material. This would still be the case if a stiffer asphalt is used, except that the movements would be slower.

Mechanically, a distinction should be made between resistance to mass flexure or shear, and resistance to being forced into sand pores or other small orifices. It is not safe to assume that there is any resistance to the mass forces; the properties which cause the asphalt mix to be undamaged by mass movements also deprive it of mass resistances under static loading. An asphaltic mix can safely be used only as an impermeable membrane, never as a key against movement.

Resistance to being forced into small orifices is a matter of aggregate grading, shape of particles (interlock), maximum size of particles, surface textures of particles, etc. As this is rather important from the point of view of loss of material into large solution chambers, etc., a series of experiments along this line would be of great interest and value.

As a limiting case, pure asphalt without aggregate would extrude under continuous static pressure into pores, probably at least as liberally as would cement grout.

Owing to the complexity of the matter of securing impermeability in some cases, I would recommend that as a measure of safety a specific impermeability test be given every asphaltic mix to be used for such purposes. Grading and proportioning alone are not reliable unless in thoroughly experienced hands.

V. A. ENDERSBY
Asphalt Department
Shell Development Co.
Emeryville, Calif.

Varied Safety Factor for Steel

Sir: In his article "Saving Reinforcing Steel by Rationalizing Safety Factors," in *ENR*, May 7, 1942, p. 785, A. J. Boase makes a proposal that is really a reversion to the practice of railroad specifications of many decades ago. At that time one allowable stress was specified for dead load and another, greatly reduced, for live-load moments and shears. In the present proposal this difference is concealed in a reduction factor for the

dead load and results in much higher allowable stresses. The chief advantage in the "differential" safety factor Mr. Boase recommends is that the designer may use design tables and curves currently published.

In the last analysis we actually design for the total loads any particular structure or member is to carry. When the total design load is less than the sum of the dead and live loads determined upon, the reduction actually applies to the live load as much as it does to the dead load, even though the assumption or reduction factor is used in reducing the latter only. This condition is so very true that under the proposed method with a dead load to live load ratio of 4 to 1, the total load to be designed for results in a load less than the dead load alone, leaving nothing for the live load.

Moreover, it is very rarely that the same dead load-live load ratio will apply both to the slabs and beams or girders. The example selected by Mr. Boase as illustration is a case in point. If we select allowable stresses of 20,000 and 900 psi. for steel and concrete, respectively, with a modular ratio of 12, a 4-in. slab having a 3-in. effective depth will have a resisting moment of $139 \times 3^2 = 1{,}251$ ft.lb. Thus, designing for a total load of 150 lb. per sq.ft. (50 lb. dead and 100 lb. live) results in a span of

$$l = \sqrt{\frac{1{,}250 \times 8}{150}} = \pm 8 \text{ ft.}$$

For the girder carrying this width of span the live load will be 800 lb. per lin. ft. so that the dead load to maintain the 2 to 1 ratio will be 1,600 lb. per lin. ft. Now deducting 8×50 lb. for the slab's dead load, there remains 1,200 lb. per lin. ft. for the dead load of the girder under the slab. Assuming a 2×4 ft. cross-section (1,200 lb. per lin. ft.), the effective depth of the girder would be $52 - 2 = 50$ in. This girder gives a resisting moment of $139 \times 2 \times 50^2 = 695{,}000$ ft.-lb. and the span length for a 1,600-lb. load per lin. ft. is

$$l = \sqrt{\frac{695{,}000 \times 8}{1{,}600}} = \pm 59 \text{ ft.}$$

Still another danger in the substitution of 70 percent for the full dead load is in calculating deflections, particularly in view of the fact that the higher allowable stresses permit shallow depths. The designer may lose sight of the w or total uniform load and find a smaller deflection than the actual. In this case the higher the dead load-live load ratio, the greater the possible error.

Moreover, other difficulties are presented by Mr. Boase's plan, for current methods of design almost invariably include consideration of temperature, shrinkage, wind and very often side sway. The use of the reduction formula would introduce many complications and possibly unfortunate results.

The proposal that would appeal to the writer is the use of a reduced safety factor where an analysis is made for all conditions of loading such as enumerated previously. Then, the only uncertainties remaining would be possible overloading, effects of fatigue and variations in the quality of the materials. Tests for determining the uniformity of the materials should then be an important element in determining the safety factor to be used.

There is no question that the conservation of reinforcing steel during the emergency is an all-important matter. It is generally agreed that for that end unbalanced sections of reinforced concrete are desirable, just as they would be if steel was very costly and the price of concrete low.

M. HIRSCHTHAL
Concrete Engineer
Delaware, Lackawanna & Western R.R.
Hoboken, N. J.

Hawaiian Bridge Rockers

Sir: In *ENR* March 12, 1942, p. 421, appears the article "Concrete Rockers for Hawaiian Bridges" by Lieut. Russell C. Brinker, C.E.C., U.S.N.R., in which it is stated that "a suitable design theory (for these rockers) has not been evolved. It follows that the proportioning of all rockers is arbitrary."

This statement is not correct. A very definite, although rather involved theory regarding the stresses in a rocker, has been developed. This theory makes it possible to design the rockers for the loads they are to carry, and they are so designed by the bridge department of the division of highways of the Territory of Hawaii.

There is nothing arbitrary about the proportioning. That the standard rockers now built are 24x24 in. in cross-section and 36 in. high is also a false statement, as the dimensions depend entirely on the requirements of the particular location in which they are to be installed. We have constructed rockers of many different sizes.

The detail of the shear plug shown on p. 422 was apparently taken from the drawing of a rocker with curved ends, as formerly used. In a rocker with a flat bearing area on a rolled lead plate the surface of the shear plug receptacle must naturally be flat.

The Kaukonahua Bridge, whose picture appears at the head of the article, is not an early, but the last constructed bridge in which concrete rockers were used.

WILLIAM R. BARTELS
Senior Highway Bridge Engineer
Department of Public Works
Division of Highways
Territory of Hawaii

Nails in Plywood Girders

Sir: We read with a great deal of interest, in your April 23, 1942 issue, p. 625, the article "Plywood Girders Roof a Warehouse." Naturally, because of our close association with the plywood industry, supplying to them the water-resistant and waterproof glues which they use, we were interested to see this publicity on a relatively new use of the versatile product.

As you perhaps are aware, our company has worked very closely with the plywood industry as well as with contractors and others in the development of plywood for girders and many other uses in modern construction. The point that I wish to comment on with regard to your story is the large number of nails that were evidently used in the fabrication of these girders. These nails might, to our way of thinking, have been much more effectively and easily replaced by the use of modern, self-bonding glue.

It seems, as we view the pictures, that literally thousands of nails were used in order to effect the adhesion which we know from laboratory tests and experience is not as strong as a glue bond. At the same time, glue, of course, does not use critical materials. For instance, we have found that in the affixing of plywood panels to studdings that $1\frac{7}{16}$ ounces of glue (2 tablespoonsful) does the work of from 60 to 120 nails. I should imagine it might be the same thing with regard to making these plywood girders.

GEORGE PAMPEL
I. F. Laucks, Inc.
Seattle, Wash.

EDITORIALS

VOLUME 128 NUMBER 23

June 4, 1942

Air-Raid Shelters Too Costly

THAT MATERIAL REQUIREMENTS and cost would be prohibitive in attempting to provide air-raid shelters for the residents of our coastal cities is clearly indicated by a 50-person shelter recently built at a cost of $300 per person. The per capita cost and material demands could perhaps be reduced by mass construction and by building larger shelters, but even if the cost were reduced by two-thirds, it would still be too much. Under present conditions, the money, materials, construction equipment and skilled labor that would be required for air-raid shelters are needed for offensive operations. Winning battles is the best way to provide protection against air raids.

Change Needed

WPA WORKERS are putting on a shameful exhibition of loafing at a number of the army and navy establishments where they are being used for minor construction jobs. How the military authorities continue to stand for this dawdling is difficult to see. Not only is time and money being wasted but, because most of the WPA work is in and around occupied camps where men in the armed forces work from dawn to dark learning the art of war, the effect on morale is distinctly bad. If we can't admit the obvious fact that WPA has outlived any usefulness that it may once have had, we should at least not exhibit its shortcomings on the parade ground. The boys who board the transports should not have to do so with any idea that one of the freedoms to be defended is freedom to loaf on the government payroll. Unless military authorities toss some of these WPA crews off of their posts there is bound to be some misgiving on the part of the soldiers as to just what they are fighting for.

Freeze Them Near Home

THE PLAN of the War Manpower Commission to "freeze" war workers in their present jobs is probably a step in the right direction to eliminate "pirating" of workmen, but in most cities it would also freeze traffic congestion for the duration. Considering the scarcity of materials and construction labor, engineers are finding it all but impossible to build new traffic facilities, and transport experts have about exhausted their bag of expedients to move traffic over existing streets, roads and bridges. One more major change is, however, being considered in several war industry cities. That is to reshuffle the factory workers so that each will work in the plant nearest his place of residence. Such a move, if possible, would eliminate much crosstown travel, conserve the workers' energy and time, and save tires and gasoline. Before the workers are tied to their jobs permanently, it would be well to examine this reshuffling plan most carefully. If they are to be frozen to their jobs, it would seem desirable to freeze them near home.

Low-Cost Schools

WAR WORKERS REQUIRE not only houses but schools. Insistence upon the schools is relatively new, though this may be because of emergency conditions earlier. However, as soon as well-built, attractive homes became available, even though they were light, demountable or otherwise of temporary nature, the workers demanded nearby schools, at least for primary grades. In California this demand is being met by construction of a type on a par with that used in the housing projects. It is refreshing to find attractive and efficient classroom facilities provided in 90 days at a cost of only $3.50 per sq.ft., 45 percent less than for conventional types. It is timber construction, to be sure, such as would be forbidden in large cities, but it is believed to be quite safe in a fire emergency, since pupils can escape readily from the one-story structures. Schools of the type recently completed in California, with life expectancy of 15 to 20 years, are likely to be popular for the duration.

Earthquakes and Bomb Explosions

BECAUSE both are attended by shock and vibration, earthquakes and bomb explosions have sometimes been considered to have elements of kinship. West Coast engineers, however, who are our best practitioners in the art of earthquake-resistant construction, have been quick to point out that if kinship exists it is obscure, and that attempts to draw too fine a comparison from present knowledge are futile and perhaps dangerous.

It is noted, for example, that while very light structures have a high resistance to earth shock because of low inertia, they are apt to be blown down by bomb blast or riddled with flying steel

fragments; and, conversely, that masonry structures that might provide protection from fragments have relatively low collapsing resistance to earthquakes. While it is generally agreed that the framed structure, of steel or concrete, resists both quakes and bombs equally well, walls should be rigidly fastened to the frame for earthquake resistance whereas it is possible that they should be loose enough to blow out under bomb blast. Finally, earthquake vibrations are caused by forces that may act for seconds or even minutes, while bombing vibrations result from forces that act for only a fraction of a second, during which time they are first positive and then negative in direction.

Despite these cited differences, however, earthquake-resistant design offers one lesson in the present quest for resistance against bomb explosions. It is that we must rely heavily on examination and study of actual bombing damage. It was only after observing the effects of the Santa Barbara and Long Beach quakes that West Coast engineers were able to make their design procedures practical. Unless the British provide us with more detailed qualitative data on bombing damage than they have done to date for fear of revealing information of value to the enemy, we will be handicapped until we have a bombing of our own or, what is more palatable, until we carry out extensive bombing experiments on actual structures. Only with much more knowledge than we now have can we compare earthquakes and bomb shock intelligently and thus draw therefrom sound conclusions as to the usefulness of earthquake-resistant principles in designing to resist bomb vibrations.

Distributors Play a Vital Role

AN UNSUNG CHAPTER in the war construction effort has been the service performed by the equipment distributors during the past months in their essential contribution to the production of materials and facilities for the fighting forces. Demands for construction speed on cantonments, ordnance works, industrial plants, housing, shipyard and airports have placed a super-premium on the output and endurance of equipment. It is the equipment distributors through their day-and-night repair service and their special knowledge of equipment maintenance who have kept many a contractor from dropping behind his schedule.

Even under peacetime conditions, construction machinery takes brutal punishment as it performs under the dictates of contractors, but these normal requirements have been met through the coordinated efforts of the manufacturer in building efficiency and stamina into the equipment, and the supplemental service of the distributor in getting it to the job and aiding in making its operation effective. Over a long period of years this system has been developed until the distributors' knowledge of equipment in relation to job requirements, their counsel on operating procedure, and more important, the facilities for providing repair parts, servicing and complete reconditioning, have come to form an essential element in the construction industry.

Today, with machines working around the clock under terriffic demands for output, and with job servicing time and maintenance facilities reduced to a minimum, the distributors have been required to take over an even more important behind-the-scenes function and have redoubled their efforts to keep the construction equipment in their territories operating at maximum efficiency and with minimum loss of time. For example, one distributor built and operated a servicing and repair shop on a local war project to save the contractor's time on the job. Many have expanded their reconditioning shops and have produced usable machines out of ancient models, long since abandoned. Others have organized staffs of service experts to bring counsel and aid directly to the projects in their territory. In addition, the distributors have played an ever-increasing part in acting as the manufacturers' own service organization, providing a function which most manufacturers could not possibly establish on short notice, or economically maintain under present trying conditions.

Too frequently equipment distributors are looked upon by those unfamiliar with the industry as mere marketing agencies. The past months have effectively demonstrated that this is but a small part of their function, which is to form one leg of the "manufacturer-distributor-user" tripod of the construction industry. In their aid and service to the machines fighting their way through the mud and dust of war construction projects, the equipment distributors are handling an essential part of the construction program that is creating the facilities for victory.

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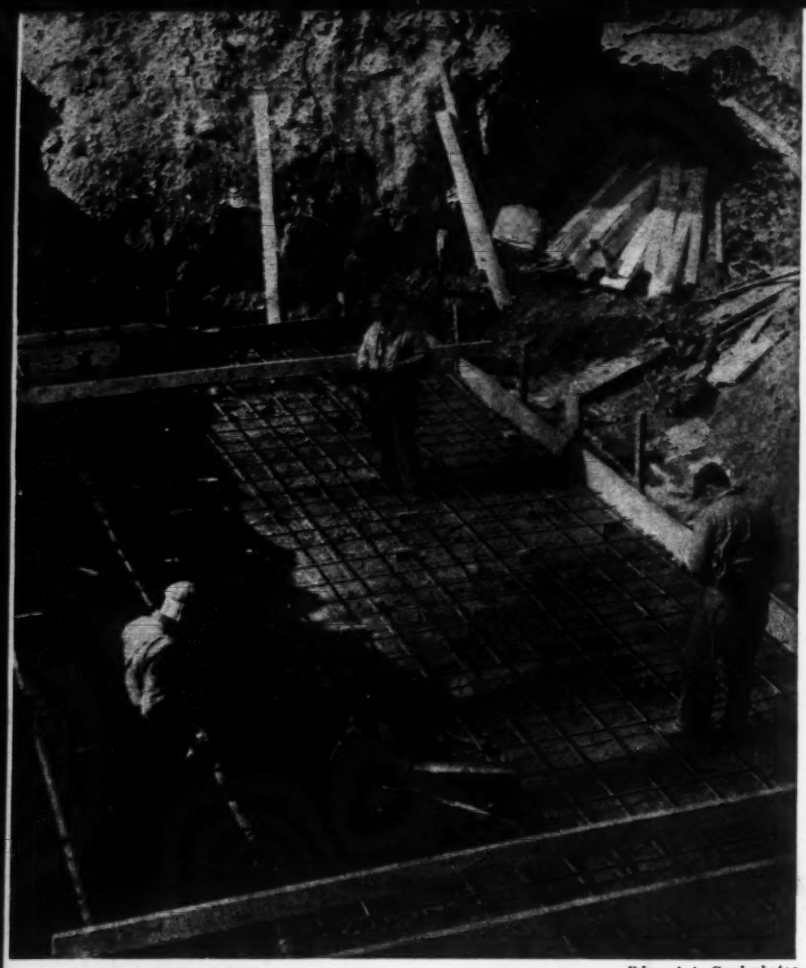
Air-Raid Shelter for Fifty People



Edward A. Card photos

The 12-in. thick concrete floor of the shelter is reinforced with ½-in. square bars on 12-in. centers each way. The underdrains lead to the 18-in. dia. pipe at the upper left corner of the slab.

***Contents in Brief**—Built to accommodate 50 people, an air-raid shelter in Connecticut has 24-in. thick walls and roof with double reinforcing; the floor is a 12-in. slab with ½-in. bars on 12-in. centers each way. The structure is designed for an earthfill covering surmounted by a 3-ft. thick burster slab.*

WHAT IS BELIEVED TO BE one of the first air-raid shelters built in the eastern part of the United States is now nearing completion at Windham Center, Conn. Costing about $15,000, it is a reinforced-concrete structure completely underground, and it is designed to withstand the impact of 100-lb. demolition bombs.

There are two entrances and the passageways are so constructed that they may be used as decontamination rooms in a gas attack. Facilities are provided for heating and cooking, and a water supply and emergency power source are available. To aid ventilation two pipes extend through the side walls and 20 ft. above the burster slab. The central room is 12x25 ft. and, on the basis of 6 sq.ft. per person, will accommodate 50 people.

An accompanying drawing gives the thicknesses of the walls and roof and indicates how the shelter originally was to be covered by a minimum of 6 ft. of earth and a 3-ft. thick burster slab to extend well beyond the shelter's main room. The fill has been added and by addition of the slab, which has been omitted temporarily, the shelter would be ample to withstand the impact of 600-lb. demolition bombs.

The structure was designed by Robert W. Loomis, structural engineer of West Hartford, Conn., and the procedure followed was similar to the methods outlined in *Engineering News-Record* by Harold E. Wessman and Wm. A. Rose (Aug. 28, p. 301 and Sept. 11, 1941, p. 349). Reference was also made to *Civil Air Defense*, Lt. Col. A. M. Prentiss, McGraw-Hill Book Co., first edition, 1941.

The original design called for about 500 cu.yd. of concrete, including 260 cu.yd. for the burster slab. About thirteen tons of reinforcing steel and 100 lin.ft. of concrete pipe

Walls of the main room were constructed with two layers of reinforcing.

were used. Materials for the concrete work were delivered in transit mixers and cement and water were added at the site.

Heavy reinforcing used

The walls for the tunnels and the fan room and the end walls of the shelter proper are reinforced on the inside and outside faces with ½-in. square horizontal bars on 24-in. centers and ½-in. square vertical bars on 6-in. centers. For the shelter's side walls ½-in. square bars on a 6-in. spacing, horizontally and vertically, are used at both the inside and outside faces.

The roof slab over the tunnels, the fan room and storage area have ½-in. square bars on 6-in. centers each way, while the roof slab over the shelter proper has two layers of reinforcing. For the top layer ½-in. square bars on a 6-in. spacing transversely and ½-in. square bars on an 8-in. spacing longitudinally are used, and the bottom layer is the same except that the transverse steel consists of ⅜-in. bars on 6-in. centers. All floor slabs, including the stair landings and stair slabs, and the burster slab have ½-in. square bars on a 1-ft. spacing each way. The 12-in. thick side walls for the storeroom and the stairs employ ½-in. square bars on 2-ft. centers vertically and longitudinally.

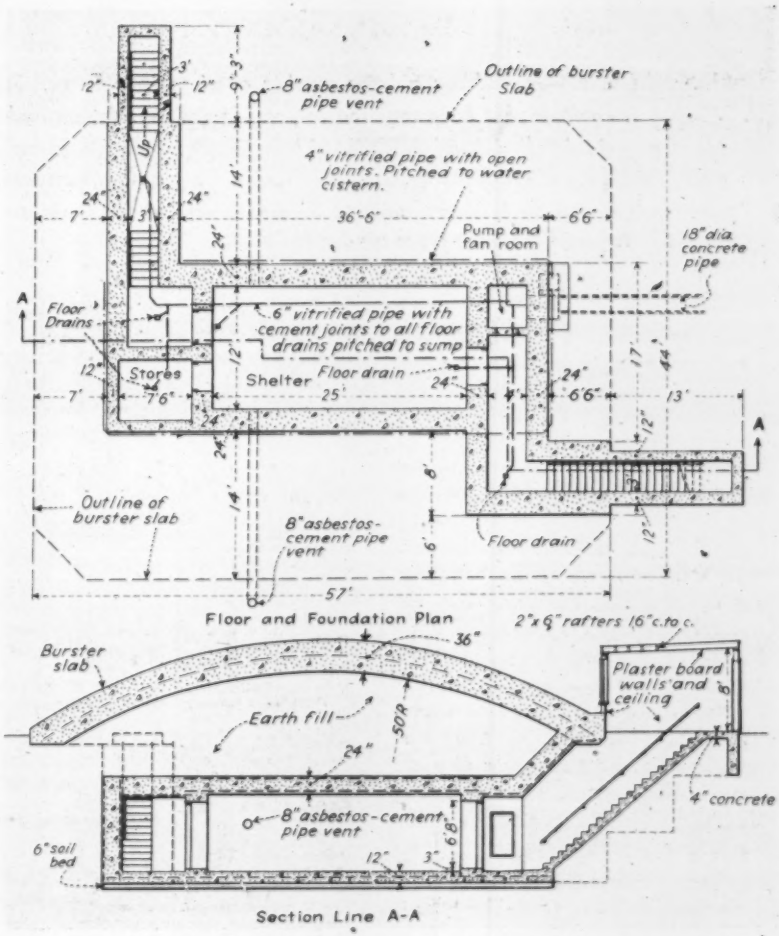
Construction of the shelter required about two and one-half months. When the placing of concrete was in progress ten men were needed, but between placements only three or four were employed. Excavation was with a power shovel and the backfilling was by bulldozer.

Drains surround structure

Open tile drains of 6-in. dia. are used around the outside walls and these drains lead to a fresh water well in the structure. This well overflows about 5 gpm. into an 18-in. dia. concrete pipe, which drains by gravity to a point on the hillside approximately 125 ft. away. Drains underneath the floor of the shelter are also employed and these are connected to the 18-in. pipe but through an independent sealed system that prevents contamination of the water supply.

The shelter was a gift to the townspeople of Windham Center from DeWitt M. Lockman, New York City artist. It is located near the town's hospital and was built by the Jones Auto Co., Willimantic, Conn.

The shelter complete except for the entrance ways, the earth covering and the burster slab.



Main room of the shelter, which is designed for 50 people, measures 12x25-ft. To date the burster slab shown has not been built. When it is added protection against 600-lb. demolition bombs will be provided.

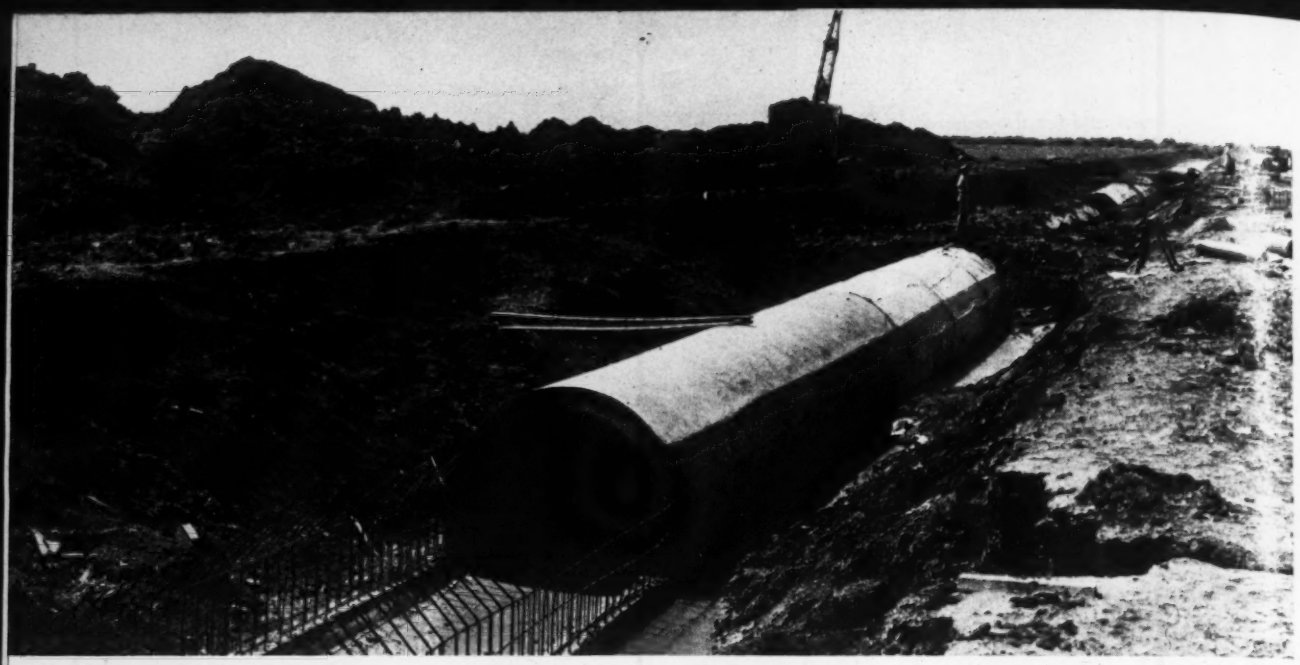


Fig. 1 The anticipated runoff from one Texas airfield made this 7½-ft. wide interceptor necessary.

Three Types of Airport Drainage

***Contents in Brief**—In building a large number of airports in Texas, the U. S. Corps of Engineers has been required to provide drainage for airfields at sites of varied rainfall and soil condition. Three general drainage systems are being used, each of which has special applications. Data as to the amount of pipe required and the cost of draining a field with each of the types are given. Advantages of the three types are listed.*

THREE GENERAL TYPES of drainage are being used by the Galveston, Texas, District, U. S. Corps of Engineers, in building numerous Texas airfields as part of the war program. The systems vary in two major respects, depending on grading of the areas to be left unpaved and the type and location of the drains.

With Type 1, French drains are used and there is very little grading, except for the paved areas, since the natural contours are depended upon to control surface flows. In cases where unpaved areas are so graded as to give adjacent plots opposite slopes, Type 2, known as the sawtooth system, is used; French drains also are used in this system. In constructing the third type—designated the catchbasin and ponding system—the unpaved areas are so graded as to provide brief storage at the catchbasins during heavy storms; no French drains are employed. The three types may best be described by typical installations.

A good example of Type 1 is the drainage network shown in Fig. 4, which is for an 1,100-acre field. Here six runways of plain concrete 150 ft. wide by 5,000 ft. long, will be available but the field's use will require

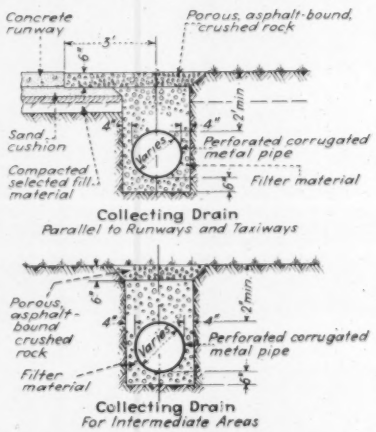


Fig. 2. Type of French drains built for field shown in Fig. 3. Corrugated metal pipe is perforated only along the lower one-third of its perimeter.

that landings be permitted over the entire site. In all, 545,000 sq. yd. are paved for runways and taxiways and 475,000 sq. yd. for the apron areas. Three important factors in determining the best type of drainage were: heavy rainfall; extremely flat site, located in a rather low swampy area where little natural drainage is available; and a very tight clay soil, designated A-7 (PRA classification), over most of the area.

Metal pipe used for drains

The drainage system is designed for a 2-in. rainfall in four hours. Corrugated metal pipe, perforated for the lower one-third of its circumference and covered by at least two feet of filter material, is used for French drains of the type shown by Fig. 2. This piping varies in diameter from 8 to 18 in., except for a line parallel to the apron, which is from 12 to 54 in. Slopes for the drains range from 0.08 to 0.20 percent. A French drain is used along either side of all taxi strips and runways, and the drains for the intermediate areas are either parallel or perpendicular to a runway or taxi strip. Some 124,680 ft. of perforated corrugated pipe was required for building the primary lines.

Flow from these primary lines is carried to the edges of the field by

3,630 ft. of unperforated corrugated metal pipe, 16,175 ft. of reinforced-concrete pipe varying in size from 15 to 45 in., and 4,400 ft. of concrete arch 7½ ft. wide and ranging in height from 4¼ to 5¾ ft. This network discharges at various points into the open ditches along three sides of the field that concentrate the entire flow at the southeast corner of the field. From there it is carried away through a large open waterway emptying into a bayou. The unperforated metal and concrete pipe is covered with at least 2 ft. of earth. A minimum of 3 ft. covers the reinforced-concrete arch. Grades on the main interceptor vary from 0.08 percent minimum to 0.2 percent maximum, with the average about 0.12 percent.

Drainage cost $808,000

Total cost of this drainage system was $808,000, with an additional $66,300 spent in placing 170,000 cu. yd. of fill for the subgrade and shoulders. On the average, 650 men were employed in doing the paving and drainage work—the maximum for any one day was 1,013 workmen—and about half the men worked on the drainage construction. Roughly six months were required for all this work, but for long periods, perhaps two-thirds of the time, construction was delayed due to heavy rains. On many days all operations had to be shut down.

Method of construction

The construction procedure was to rush to completion the taxiway crossing the field at the midpoint. This was to permit early use of this pavement by trucks supplying materials for the drainage work. The arrangement proved an excellent plan, for much of the time it was almost impossible to drive trucks onto the field at other points. While the rest of the paving was being constructed all phases of the drainage work were underway at once. But, because of trouble from rain, the general contractor ordinarily did not open up more trench for the French drains than he could fill with filter material that day.

A dragline prepared the ditch for construction of the arch interceptor. While this work was in progress, trenchers did the excavation for the French drains and the concrete-pipe interceptors. With the perforated piping in place for the drains, the filter material was delivered by truck and dumped directly into the trenches for spreading and compaction by hand. The unpaved areas between the drains are to be sodded.

The Type 1 method has an advantage in that little grading for the unpaved areas is necessary, but it has the disadvantage in that much hand labor is required in building the French drains.

Sawtooth drainage system

The sawtooth drainage system (Type 2) has been used at three fields to date. Its major advantage over the type previously described is that much less pipe per acre is needed. How-

Fig. 3. Excavation for French drains of Type 1 airport is by trencher. Crane lowers into place the required corrugated metal pipe, which is perforated for the lower one-third.

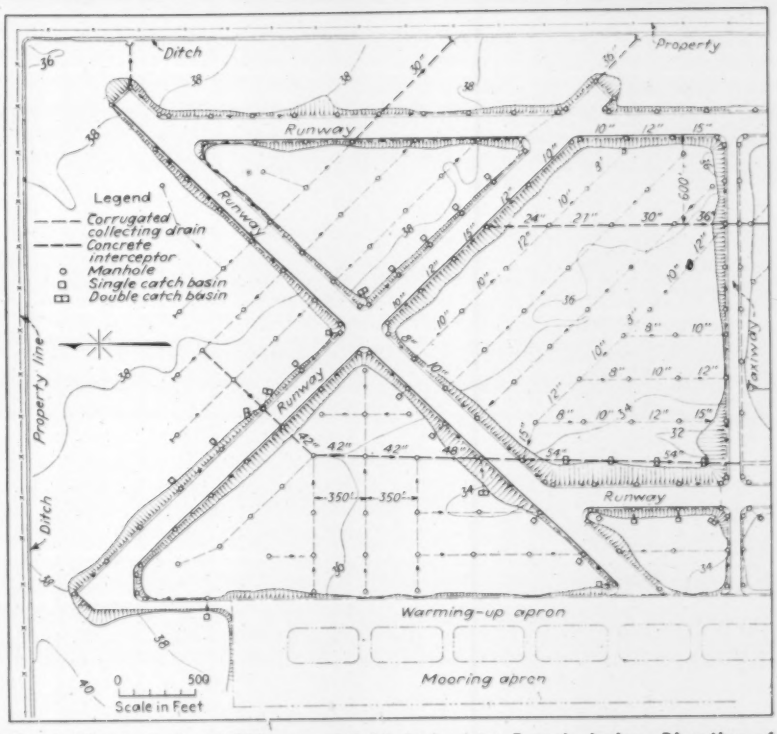


Fig. 4. One-half of a 1,100-acre airfield drained by French drains. Direction of surface flows is determined by the natural contours. The pavement is symmetrical about the taxiway at the right, but the drainage system is unsymmetrical, as general direction of flow is toward the upper right side of the drawing. Large concrete-pipe interceptor just above lower horizontal runway continues across field as concrete-arch interceptor. Typical pipe sizes are shown.

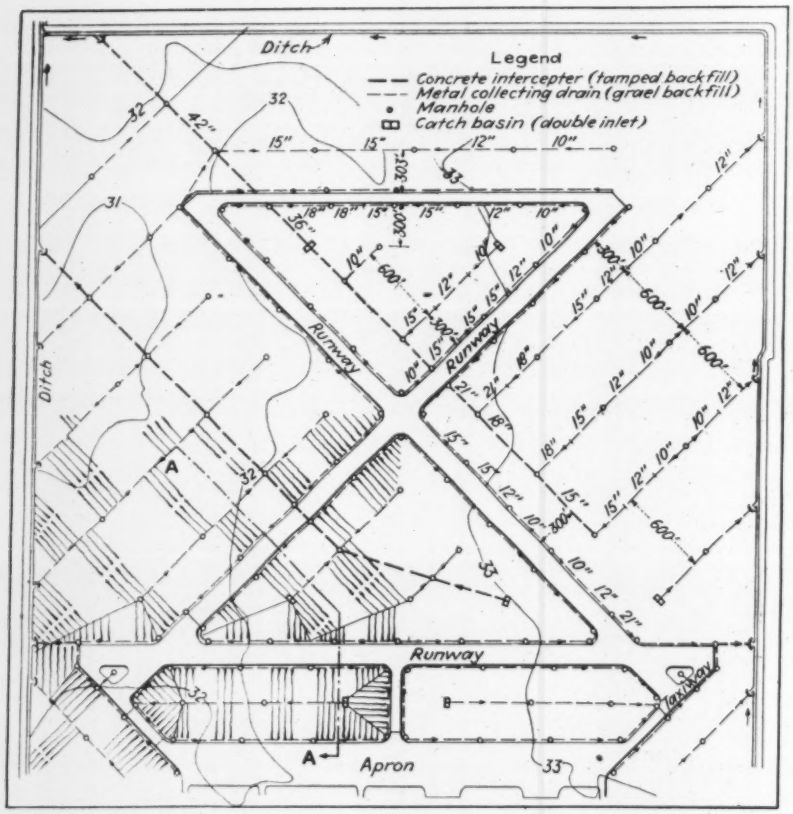


Fig. 5. Sawtooth drainage system for a 635-acre airport. A few pipe sizes are given to show general drainage scheme. Grading similar to that illustrated at left was required over the entire field.

ever, construction is a much slower job due to the careful grading.

Such a system for a 635-acre field is shown by Fig. 5, while in Fig. 6 is illustrated the sawtooth effect due to the grading required at adjacent unpaved areas. At this field single and twin-engine airplanes are to be used and the field is to provide an overall landing area for a gunnery or advance school. The soil encountered is listed as A-6—a fine tight soil with lots of clay. The rainfall is heavy; the field is extremely level; and little natural drainage is available.

This drainage system, like Type 1, is designed for a 2-in. rainfall in four hours. Here also corrugated metal pipe, perforated for the lower one-third of its perimeter and varying in diameter from 6 to 24 in., was used in construction of French drains along either side of all runways and taxi strips and for draining the large unpaved areas. All the latter areas are graded so that there is a slope at all points of one-half percent toward a nearby drain.

In addition to the French drains being of the same type as for the first field mentioned (Fig. 4), the two systems are similar in that reinforced-concrete pipe, varying in diameter from 12 to 42 in., is used for the interconnecting mains.

Grading for the runways, which are raised about 1½ ft. above the neighboring areas, was carried out simultaneously with the earthwork for the unpaved areas. For most of this work tractors and patrol blades were used, but a few carrying scrapers were employed.

All the grading in an area had to be completed before the French drains could be built. In all, 300,000 cu. yd. of earth were moved in preparing the site, this cost $117,000.

Construction of the Type 2 drainage system was similar to Type 1 but it required only 63,750 ft. of corrugated metal pipe and 9,720 ft. of reinforced-concrete pipe. This means an average of only about 100 ft. of French drains were needed per acre, while the Type 1 field shown in Fig. 4 required considerably more. Type 2 drainage required less piping per acre because the runoff is controlled in a manner permitting minor ponding for the heavier storms, while the arrangement for the piping for Type 1 is determined by the topography and should, as far as practicable, intercept most of the runoff. Drainage work for the Type 2 layout cost $465,000. Of the 600 men employed on all paving and draining operations about one-half were employed on the drainage works. Six months were needed to complete all the construction.

Catchbasin and ponding system

At four fields the drainage method known as the catchbasin and ponding system (Type 3) has been used. For the catchbasin and ponding arrangement no French drains are used and thus no perforated pipe was required. Instead, corrugated metal pipe (not perforated) and reinforced-concrete pipe were used. All the concrete pipe is of the extra-heavy type and the minimum cover is 4 ft.

The inlets and catchbasins are of reinforced-concrete construction, and all the inlets are covered with grating. Both solid and open covers are used for the manholes. The pipe used to

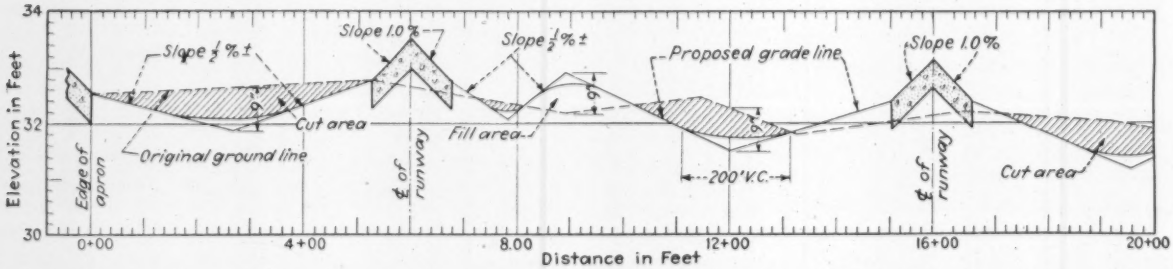


Fig. 6. Surface details along section A-A in Fig. 5. This is typical of the grading carried out over the entire field.

connect the catchbasins and the concrete interceptors is mostly of clay. The connections were varied from 6 to 24 in. in diameter, to prevent discharge from one inlet causing water to back up at succeeding inlets. It is assumed that a ponding of 6 to 8 in. over the catchbasins will occur during the most severe storms. The main drains are designed to take care of future expansion.

Much less hand work

The catchbasin and ponding system has the advantage of confining ponding due to overload to selected areas which do not interfere greatly with normal flying operations. There is another advantage in that this construction requires much less hand work than is needed with the other systems, since the filter material about the perforated piping for the French drains must be spread and compacted by hand, while with the catchbasin and ponding method the top portion of the backfill for the piping network may be placed with mechanical equipment.

Engineers' recommendations

To date no trouble has developed with any of the three drainage systems, but of course the fields have not been in service long enough to determine the most satisfactory type. Still, from the extensive airport work to date, the engineers of the Galveston district have arrived at certain conclusions with respect to designing airport drainage systems. An important one is that Type 3 drainage must be planned very carefully for plots which may be used for landing areas.

Assuming that each field is to be considered a problem in itself, and that the services of both an experienced drainage engineer and a good hydrologist are available, they would suggest: That the drainage system be designed for the worst conditions expected, within reasonable economic limits, as the loss of one large airplane due to poor drainage could easily be more than the cost of extensive drainage construction; that the drainage works actually built be designed with consideration to ultimate development where there is a possibility of the field being enlarged; and that subsurface contour maps to show soil conditions at the site be made as they are of great value if based upon frequent borings. Such maps proved very worth while for all fields built to date by the Galveston district.

The subsurface maps are prepared with respect to the soils encountered and show the depths of the various materials by subsurface contours. The boring frequency is determined by the time available to conduct the work and the extent of the area to be covered. As much subsurface data as possible is obtained to minimize the assumptions made in planning and design.

Col. L. H. Hewitt is district engineer for the U. S. Engineers at Galveston; Maj. Frank H. Newman, Jr., is in charge of the engineering division; and H. R. Norman is in direct charge of planning and design.

Tests of Underdrain Filters

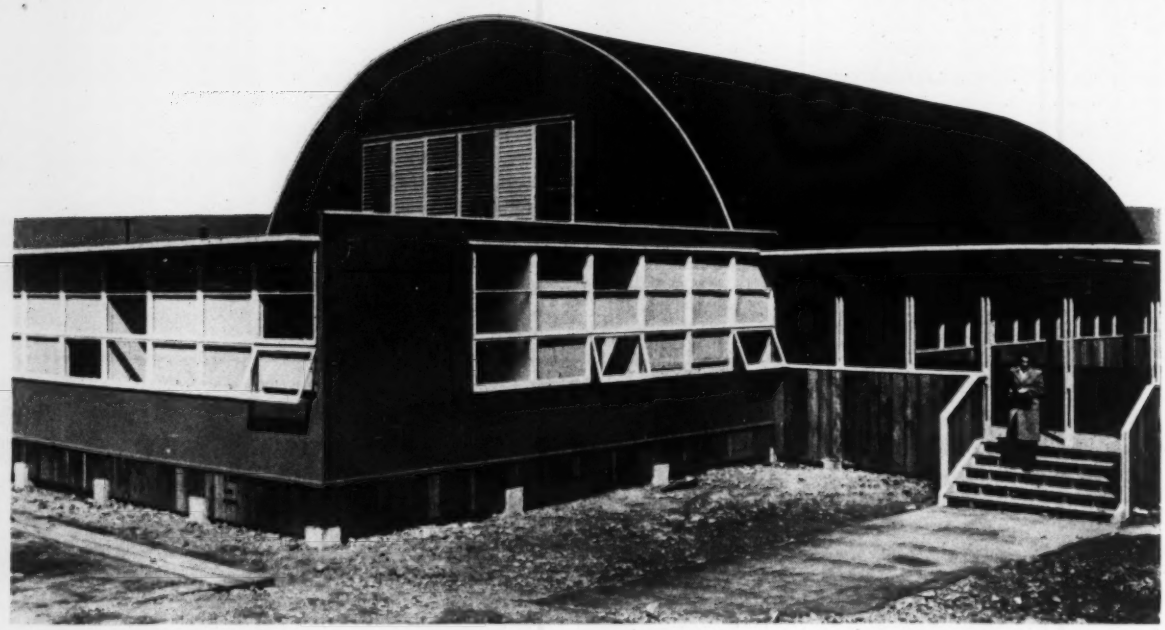
AN ABSTRACT of a report by the U. S. Waterways Experiment Station, Vicksburg, Miss., entitled "Investigation of Filter Requirements for Underdrains" published in *Engineering News-Record* March 12, 1942, p. 400, was incomplete in that the abstract did not emphasize the fact that the study, as stated in the report, was limited to a single filter material that had been designed to exclude from the underdrains being tested the fine sandy soil found along the lower Mississippi River. This base material had a grain size range from 0.30 down to 0.05 mm., or approximately from a 48 mesh to a 200 mesh screen. The report states that "it was not intended in this investigation to choose filter materials for many types of natural soils. The plan was rather to choose a fine-grained natural soil highly susceptible to movement by flowing water, and to select a filter material which would drain this soil without piping."

The report further states that it was originally planned to design a filter material for each type of drainpipe that would hold the base material and would not wash into the pipe. However, it soon became evident that there was no single filter material available which would fulfill both these criteria for pipe with the larger openings. Using a filter material, which based on laboratory tests was the coarsest possible without allowing the inwash of fines from the base material, field tests were performed to observe which types of drainpipes were most suitable for draining the selected filter material without the use of multiple layer filters."

The filter consisted of one layer of a single grade of filter material made up of medium and fine gravel, coarse sand, and a small amount of medium sand. The size range was from a little under 10.00 mm. to 0.40 mm. This material was placed around and above the pipe until each type of the pipe had a minimum cover of 12 in. of filter material.

In the test procedure a small tailbay was used to collect material coming through the pipe under test, also to form a stilling basin for the V-notch weir used to measure the flow. Those pipes allowing entrance of large quantities of the filter material through their unsealed bell and spigot joints would have the material accumulate in the tailbay and in the pipes to such an extent that the clogging referred to in the report was observed. This term "clogging" was used in the *Engineering News-Record* abstract of the report in this same qualified sense without explanation of the conditions under which "clogging" occurred. Such a condition would not exist in a well-designed system of underdrains for, as indicated in the report, the pipes collecting the larger quantities of filter material could probably be used satisfactorily with a double or triple layer of graded filter.

As attempts are now being made to apply the findings of the report as given in our abstract to the many drainage studies being made in connection with the nation's expanding airport program, it is necessary, in fairness to manufacturers of the several types of drainpipe that made less favorable showings in the tests to emphasize the nature of the tests and to point out that similar unfavorable results would not be produced with filters designed to suit both the type of pipe used and the soil conditions at the site where the pipe is to be installed.—EDITORS.



Open corridors facing the classrooms of this low-cost school provide a maximum of fresh air, light and sunshine.

Low-Cost Schools in War Plant Areas

***Contents in Brief**—One-story school buildings to house 800 to 1,200 and designed to provide a maximum of fresh air, light and sunshine for children living in large housing projects in areas near war production plants, are being built in California in 90 days at the low cost of $3.50 per sq. ft., including utilities, grading, site improvements and paving. Structural materials are principally plywood panels prefabricated at the mill to speed erection.*

TWO SCHOOLS recently completed in California as adjuncts to war housing projects for industrial workers each provide for 800 to 1,200 pupils in an attractive and effective classroom arrangement at a cost of about $3.50 per sq.ft. This cost includes corridors, auditorium and overall items on the projects such as utilities, grading, site improvement and paving. This is said to be 45 percent less than current costs for school buildings of the conventional type. On concrete footings and of a timber construction whose life expectancy might be 15 or 20 years, these designs have met an urgent need for low-cost facilities to be built quickly with materials available locally.

Both schools are one-story structures, which minimizes fire hazard and keeps the required framing materials within a size range nearly always available. Built along almost identical lines, the two schools have 23 and 26 classrooms, respectively, designed for 40 to 50 pupils per room. Structural materials are principally plywood panels made up at the mill to speed erection. Both schools have corridors open on one side, extended, as covered walkways, to toilet wings at one end of the buildings. This reduces the utilities required in the classroom buildings themselves to electricity for lighting, gas for heating and one classroom sink in each room.

Each school has an auditorium, in one case 56x80 and in the other 56x96 ft. in plan. Even the auditoriums, which are the only departures from the type of construction used throughout classroom buildings, use panels made up of plywood and the walls begin the curve of the dome from the floorline. Auditorium roofs are carried on timber arches spaced on 16-ft. centers. Plywood panels, 4x16 ft. in size, shaped to the curve of the arch, simultaneously form the ceiling and carry the roofing.

Construction of typical classroom buildings begins with the pouring of concrete in a hole dug 5 ft. deep with a 10-in. posthole auger. Piles thus poured in place are surmounted by a square cap, the only part of the footing that required forms. A single ⅝-in. reinforcing rod is centered in each pile. These pile footings, underlying all of the buildings on a rectangular 8x11-ft. spacing, are all finished off on the same level where the site could be leveled in advance.

Where there was some slope to the ground, the piles are simply topped out at ground level and timber posts are used to support the floor girders. To prevent lateral forces from thrusting the girders off their concrete piles, a steel dowel, centered by being passed through a hole in a piece of plywood covering the pile top, is thrust down into the fresh concrete. When girders are placed, this dowel, fitting into a hole, automatically centers the girder.

These girders consist of 3x8 and 4x10 timbers reaching across the 11-ft. spans. This makes an economical layout for the 22x40-ft. typical classroom. Plywood guessets, ⅝ in. thick, between floor panels and foundations constitute bracing against lateral forces on buildings with low floor levels. Where the floors are raised by reason of a sloping ground surface, diagonal bracing is used.

Supported on the girders are 4x8-

ft. plywood-surfaced floor panels that make up the entire floor area except corridor walkways. The corridors, which are exposed to the weather on one side, have floor panels consisting of a frame of 2x6 timbers with a pair of interior 2x6's placed lengthwise and stiffened by headers at the $\frac{1}{3}$ points. The top surface of each frame, which is the floor wearing surface, is $\frac{5}{8}$-in. plywood.

Built thus to exact specifications in the mill, the floor panels are brought to the job, dropped into place and spiked through the side frame members to adjoining units. In addition to those for the floor, panels of two other types are prefabricated at the mill; namely for walls and roof. All panels are put together with glue instead of nails to conserve metal. To avoid unnecessary weathering of the plywood, the best plan has been to deliver to the job only so much of the floor paneling as could be rather promptly covered over by the crews erecting walls and roofs.

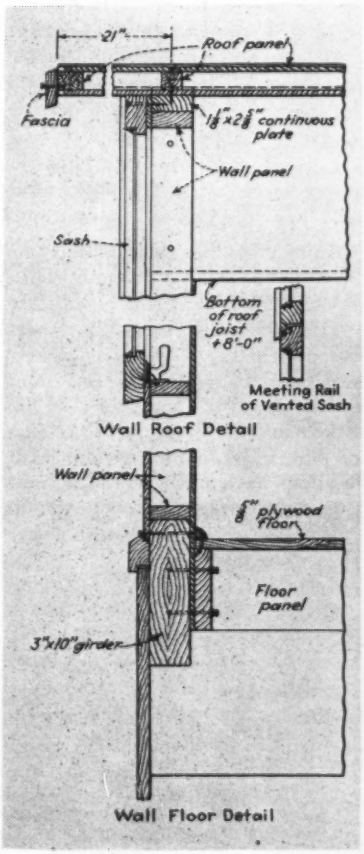
Wall panels of three types were used to meet the need for (1) full height panels, (2) panels under "transom-type" windows and (3) panels to go under the "tall" or outside windows. This standardization of wall units was typical of all the structures in which standardization was the rule. Only two sizes of window sash were used. The corridors are $7\frac{1}{2}$ ft. wide, floored by panels surfaced with 1x6 vertical-grain lumber.

Where possible the classroom arrangement was laid out so that the tall windows would be on the north side with corridor walls on the sunny side. This put the transom windows on the side where the corridor roof would screen them from direct sun's rays, thus avoiding the need for curtains or other sun protection.

Ceiling and roof construction is simplified by making such use of window frames that the ends of the 2x4-in. ceiling joists, supported on the mullions, are flanked and held in place by the uprights of the window frames. These joists, on 4-ft. centers, are surfaced on four sides, thus presenting a clean finish in the ceiling. The application of paint makes a satisfactory ceiling on the under side of the roof.

Roof panels have plywood surfaces glued to opposite sides of frames made of $1\frac{1}{4}$-in. material. On the under side the plywood is $\frac{1}{4}$ in. thick; a $\frac{5}{16}$-in. thickness is used on the roof side where the surface exposed is rough to improve bond with the roofing. Adjoining roof panels are fastened together with splines passed in between projecting ends of the plywood. Splines thus constitute a common nailing strip for both panels. These splines are placed at right angles to the ceiling joists. The roof surface consists of a 40-lb. mineral roofing topped with two layers of 15-lb. felt.

Plans for both of these school projects were developed by Franklin & Kump and Associates, architects, San Francisco. William Wilson Wurster was consulting architect.



Details of classroom wall sections constructed of plywood. This simple design influenced the low cost of the structure.

Three sizes of plywood panels faced on two sides are used for walls: (1) low panels under tall windows; (2) full-height panels in partitions and (3) panels topped by transom-type windows. Note provision for exposed roof joists at top of mullions.

War Conditions Favor Landfill Refuse Disposal

Fig. 1. Applying earth cover on the working "face" of a New York City refuse landfill operation.

Rolf Eliassen
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***Contents in Brief**—War salvage campaigns have resulted in the removal of considerable quantities of paper from city refuse, and this is working a hardship on operation of incinerators. However, absence of paper favors decomposition processes, thus pointing to the special utility of landfills for refuse disposal at this time. Dr. Eliassen draws upon laboratory studies to indicate how landfill practice may be improved.*

RECLAMATION of waste materials being one of the cardinal principles of our war effort, the sanitary engineer has been called upon to do his part in meeting changing conditions in the field of waste disposal. In ordinary times refuse material collected in large cities contains approximately 22 percent by weight and 50 percent by volume of paper. A good percentage of this paper can be reclaimed for war industries and civilian use. Citizens are cooperating in the segregation of paper from the remainder of their refuse and giving or selling it to salvage organizations, so that the volume of paper in refuse has been greatly reduced.

Many cities are faced with the problem of maintaining the practice of refuse disposal by incineration under the changing conditions of wartime economy. The effects of the salvage program on refuse incineration have been drastic. Heretofore, paper and other combustibles have furnished the fuel that is necessary to dry the garbage and other wet organic matter before combustion and consequent destruction of this offensive material can take place at high temperatures. In order to continue incinerator operation, it may become necessary to supply additional fuel, such as coal or oil. This would lead to a costly process of refuse disposal, and one not to be desired from the standpoint of the war program, as all fuels are so vitally needed for other more important purposes.

Sanitary landfills offer a timely solution to the vexing problem of refuse disposal. The efficacy of landfill disposal in normal times has been proven on many large-scale projects, as witnessed by articles describing the development and use of this method in New York, San Francisco, and other cities, both large and small. Questions have arisen as to the feasibility of disposal of present-day refuse, with its changed characteristics, by the landfill method.

Answers to a number of these questions may be found in the results of a landfill study conducted jointly by the Department of Sanitation of the City of New York, the Works Projects Administration, and the Sanitary Engineering Research Laboratory of New York University.

Experimental results have shown that reducing the quantity of paper mixed with refuse in landfills will greatly increase the rate of decomposition of the putrescible organic matter. This is borne out by the results shown in Fig. 3 which indicates the

effect of varying the amount of paper mixed with putrescible organic matter (particularly food refuse) on the rate of decomposition of this organic matter. It stands to reason that since paper is a cellulose product, it is not readily susceptible to rapid destruction by bacteria.

From the standpoint of landfills, paper may be considered as a stable or virtually inert material, legible newsprint having been uncovered in fills ten years old. Consequently, presence of paper in mixed refuse would tend to separate the particles or masses of organic matter being decomposed by the many species of bacteria, fungi and protozoa. The less separation or interference from inert matter, the more rapid the breakdown, as Fig. 3A clearly indicates. In contrast to the detrimental effect of paper salvage on the economical operation of incinerators, landfill disposal is aided by reducing the paper content of refuse material. The resulting more rapid decomposition of the organic matter will serve to hasten the ultimate stabilization of the fill.

Fig. 2. Removal of waste paper and bulky materials from refuse, as carried on by these salvage operators, speeds decomposition and aids in fill compaction.

Further study of the results of the landfill study indicate that other benefits will be derived by the elimination of paper from landfills. For example, paper coming to a landfill is very dry and will tend to absorb moisture from other organic matter. It is a well-known fact that bacteria and other organisms require considerable moisture for the efficient prosecution of their life processes associated with the breakdown of organic matter. Therefore, in landfills it is desirable to have as high a moisture content as possible within reason.

Many analyses made during the course of the landfill study indicate that the average moisture content of refuse normally is 24 percent. Controlled studies were made on refuse material to determine the effect of moisture content on the rate of landfill decomposition. The results are shown in Fig. 3B. It will be noted that from the standpoint of rate of decomposition, the optimum moisture content of refuse in landfills lies between 40 and 80 percent. It follows that anything which can be done to increase the moisture content of landfill material will assist decomposition. Elimination of dry paper will be a significant step in this direction.

An obvious external means of adding moisture would be the spraying of water on the refuse material as it is being placed. This could easily be accomplished, as water lines with hose connections frequently are laid on the fill to prevent the spread of fires. One or two laborers could be assigned the task of guiding a stream of water into the face of the fill or into the pile of refuse dumped at the top of the fill by each truck. In addition to fire control, the benefits of accelerated stabilization also could be obtained.

In many communities landfills are placed in fresh water marshes or shallow ponds. The availability of cheap land and the desire to eliminate rat-

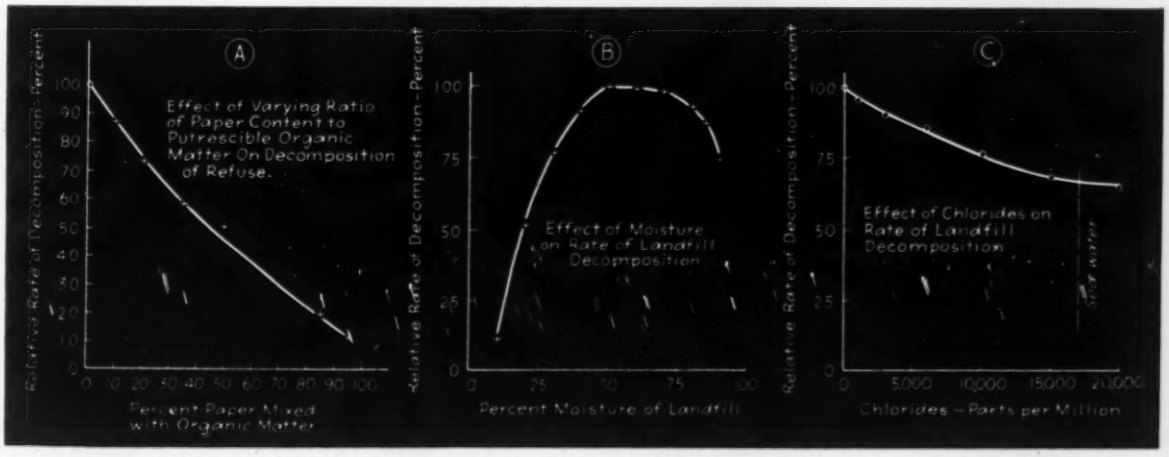
A
Effect of Varying Ratio of Paper Content to Putrescible Organic Matter On Decomposition of Refuse.
Relative Rate of Decomposition - Percent
Percent Paper Mixed with Organic Matter
B
Effect of Moisture on Rate of Landfill Decomposition
Relative Rate of Decomposition - Percent
Percent Moisture of Landfill
C
Effect of Chlorides on Rate of Landfill Decomposition
Relative Rate of Decomposition - Percent
Chlorides — Parts per Million

Fig. 2. Experimental results showing the effect of paper (A), moisture (B), and chlorides (C) on decomposition rates

infested and mosquito-breeding areas makes this a common practice. The use of pure city water to moisten the landfill might lead to an unnecessary expense, except where water is cheap and plentiful. As an alternative it would be entirely feasible to pump water from the adjacent body of water and use this for fire protection and moisture control.

Similar procedures might be followed where landfills are located in marshes adjoining bodies of salt water. However, seawater used for moistening the fills might contain chlorides to the extent of 17,000 ppm. These chlorides are known to have a detrimental effect on bacterial action. Quite properly, therefore, the question might arise whether the chlorides would have sufficient retarding effect to counteract the benefits derived from the addition of moisture to the fill.

In order to determine the extent of this retarding effect, experiments were conducted on the biological decomposition of landfill in the presence of varying amounts of chlorides, with all other factors kept constant. The results from these tests are shown in Fig. 3C. It will be noted that the rate of decomposition in the presence of moisture containing 17,000 ppm. of chlorides is only 67 percent of the rate when no chlorides are present, indicating appreciable retarding.

Applying these experimental data to a practical problem, let it be assumed that either fresh or salt water is added to landfill material containing an average moisture content of 24 percent, a figure representative of refuse in New York City. Measuring the volume of water added in gallons per ton of original fill material, the effect of this additional moisture on the rate of decomposition of the organic matter is indicated in Fig. 4.

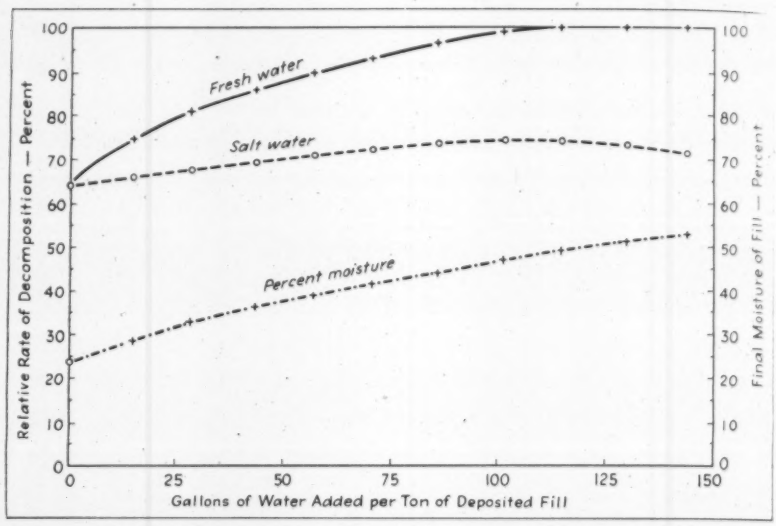

Fig. 4. Changes in the relative decomposition rate in a landfill as a result of adding fresh water or salt water. Chlorides in salt water act as a retardant.

The addition of fresh water has a marked effect, as may be noted from the curve. On the other hand, the retarding effect of the chlorides in the seawater is so great that the advantages gained from moisture addition are almost negligible. The relative rate changes from 64 to 74 percent, or an increase of 16 percent over the rate that would have prevailed had no water been added. This is not enough to warrant the effort and expense involved. If the original moisture had been somewhat less, preferably below 20 percent, interpretation of the data from Fig. 3B and 3C would have indicated greater benefits resulting from the addition of seawater to the landfill.

As a result of these studies, it may be concluded that the addition of seawater will increase the rate of landfill decomposition if the original moisture content of the fill is less than 25 percent. With fresh water, the addition of moisture will have an accelerating effect even when the original moisture content is as high as 45 percent. When consideration is given to the fact that decomposition of the organic matter in landfills is measured over a period of years, it is readily understood that anything that can be done to accelerate this action will hasten stabilization and ultimate utilization of the completed landfill area for useful purposes.

Results of experimental research may thus be used to indicate procedures which will enhance the value of landfills and make them more applicable to present-day conditions of refuse disposal. Considerable data pertaining to other phases of landfill practice are becoming available as a result of the studies made at New York University. As these results are interpreted and published, a better understanding of the phenomena encountered, as well as the structural characteristics of the stabilized fills, will become available to engineers.

Fig. 5. At the close of each day's operation, the top and sides of refuse fills in New York City are "sealed" with an earth cover. This procedure speeds anaerobic decomposition and effectively controls odors.

Viscosity of Liquid Road Asphalts Measured in Terms of Scientific Units

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***Contents in Brief**—Speed in measuring the viscosity of liquid asphalts commonly used in highway work has been attained in the laboratory of the Wisconsin Highway Commission by use of a capillary-rise viscosimeter. At the same time the laboratory has developed methods for quick and accurate comparisons of bituminous materials and for establishment of viscosity requirements on a sound basis.*

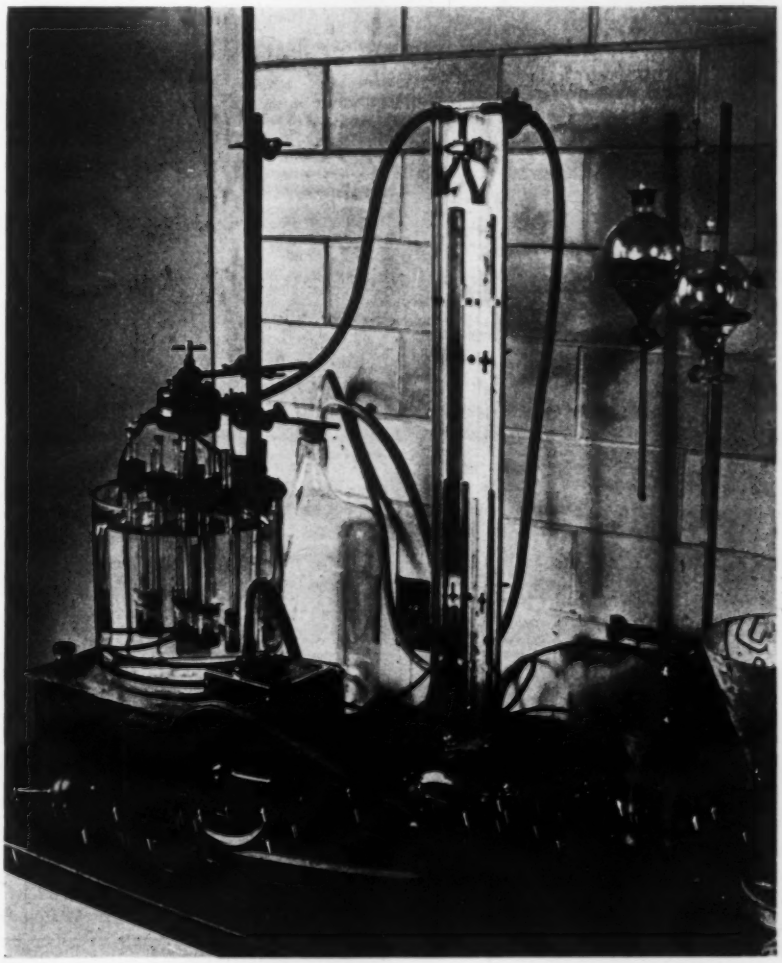
IN THESE DAYS when scarcity of many materials is making it necessary for highway engineers to make greater use of such materials as still are available, it frequently becomes necessary to compare the viscosity of different types of bituminous materials. These comparisons are made difficult by the fact that the commonly accepted units of measurement cannot be used without the application of conversion factors. These factors at best are approximations and are not always available.

In the laboratory it often is desirable to correlate consistency of a material with other characteristics or with the results of other tests. Correlations made with units in current use are not always satisfactory. Furthermore, the samples available for consistency measurements may be small, and to get larger samples would involve the expensive and often inconvenient process of obtaining larger amounts of the mix and making the necessary extractions. As a result, the determinations either are not made or are made with instruments giving results that are open to question.

Comparisons simplified

The use of such units as poises or stokes, expressing as they do the viscosity in specific terms, would facilitate the following operations: the making of direct comparisons in the field, the making of greatly needed correlations in the laboratory, and the establishment of viscosity requirements for liquid asphalts on a sound basis, as has been done with tars. Further, the use of these units would make possible and practicable the rapid evaluation of viscosity of asphalts without sacrifice of accuracy and at a materially reduced cost.

A number of instruments have been proposed for measuring viscosity in scientific units, but most of them are not suited to routine testing either because they are limited to measurements in relatively narrow ranges of viscosity, because they require special technique to operate, or because their cost is too high. An instrument of a type that lends itself to routine testing is one developed by E. O. Rhodes, E. W. Volkmann and C. T. Barker of the Koppers Products Co. for the measurement of the consistencies of tars (*ENR* Nov. 21, 1935, p. 714).



Capillary-rise viscosimeter used in the laboratory of the Highway Commission of Wisconsin to measure the viscosity of liquid asphalts.

A modification of an instrument of this type has been used for some time in the laboratory of the Wisconsin Highway Commission for the study of asphalts of the MC, RC and SC types, which have consistencies within the range of consistencies measured for tars. It consists of a receptacle into which the sample (from 5 to 10 cc. are needed) to be tested is placed. The receptacle is closed with a stopper through which are placed a capillary tube of uniform bore throughout and a tube which allows free access to the air. The receptacle with the sample, the stopper and the tubes in their proper position, is immersed into a constant temperature bath, and after a sufficient period of immersion to allow the entire sample to reach the desired temperature, the capillary tube is connected to a system through which a vacuum of desired intensity is applied. The time required by the top of the material to travel from one predetermined mark to another on the tube of the capillary is measured. This value is then used in solving the following equation (Pochettino's modified by Rhodes, Volkmann and Barker):

$$\mu\,(\text{poises}) = \frac{g \times r^2 \times \rho \times \Delta t}{8\left[\frac{l_2^2 - l_1^2}{2\left[\frac{H}{\rho}+\lambda\right]} + \frac{l_2^3 - l_1^3}{3\left[\frac{H}{\rho}+\lambda\right]^2} + \frac{l_2^4 - l_1^4}{4\left[\frac{H}{\rho}+\lambda\right]^3} + \cdots\right]}$$

Where

g = acceleration due to gravity
n = vacuum applied to the capillary tube (cm. of water)
r = radius of capillary bore (cm.)
Δt = time interval (sec.)
l_1 = length of capillary filled with asphalt at the start of time interval (cm.)
l_2 = length of capillary at end of interval
ρ = specific gravity of fluid at test temperature
λ = length of capillary submerged in sample

Although at first glance the formula is formidable in appearance, its solution is relatively simple if a systematic method is used. For routine testing, it can be simplified to the following expression:

$$\text{Viscosity in Poises} = k\,\Delta\,t$$

Using the same vacuum and different values for specific gravity a number of values for the factor k can be computed. These values are then plotted, in rectangular coordinates, against corresponding values of specific gravities. When testing a sample all that is necessary is to determine specific gravity, $\Delta\,t$, and the proper value of k from the chart. The value for the viscosity can thus be determined without having to solve each time the lengthy and complicated formula.

TABLE I — VISCOSITY, (POISES) AT 104 DEG. F. USING DIFFERENT VACUUMS

Asphalts	Vacuum (centimeters of mercury)		
	5 cm	10 cm	15 cm
RC-1	6.3	6.4	6.2
RC-1	3.8	3.8	3.8
RC-2	15.1	15.1	15.2
MC-3	49.4	49.4	49.3
MC-3	52.5	52.7	52.7
SC-3	21.3	21.1	21.2
SC-3	27.4	27.4	27.5
SC-6	50.9	50.9	50.7
SC-6	63.8	64.1	63.9
SC-7	101.6	101.4	101.6
SC-7	121.6	121.4	121.9
SC-7	138.3	138.2	138.2
SC-7	167.5	167.3	167.4

In considering the instrument for use with SC, MC and RC asphalts, it is of primary importance to know whether it is well adapted to the measurement of the viscosity of such materials; the question arises in view of the possibility that some of the materials might not be truly liquid at least at the temperatures selected for the tests.

The suitability of the instrument to the measurement of viscosity of the MC and SC asphalts is indicated by the data summarized in Table I. The viscosity values given in that table agree within the limits of experimental error, indicating that the instrument is suited to the measurement in routine work of consistencies of asphalts of the MC, RC and SC types.

The reproducibility of values obtained with the rise-in-capillary viscosimeter is of high order even with materials of relatively high consistency and with materials that contain low boiling point fractions. Data on reproducibility is shown in Table II, which also shows comparisons between viscosities obtained with a currently used instrument and with the new rise-in-capillary instrument. The values of the standard deviations for the viscosities obtained with the latter instrument are smaller and show, therefore, a higher degree of reproducibility.

The time required to make the tests using the new capillary viscosimeter is strikingly shorter than that required

TABLE II — COMPARISON OF VISCOSITIES OBTAINED WITH CURRENTLY USED INSTRUMENTS AND THE CAPILLARY-RISE VISCOSIMETER

	SC-2	SC-3	SC-6	RC-3	RC-2
Number of tests made	8	8	8	8	8
VISCOSITY					
Absolute at 104 F	8.4	19.5	64.2	39.4	14.6
Furol at 122 F	177			893	292
Furol at 140 F		99	471		
STANDARD DEVIATIONS					
Absolute at 104 F	+0.10	±0.15	±0.40	±0.37	±0.30
Furol at 122 F	±1.61			±14.42	
Furol at 140 F		±0.89	±25.10		

The presence of relatively low boiling point fractions in the RC type does not appear to affect the accuracy of the test.

TABLE III — TIME REQUIRED FOR MAKING AN ABSOLUTE VISCOSITY DETERMINATION

Material	Time to prepare one sample *	Time to test one sample	Time to clean apparatus (one sample)	Total time
SC-2, RC-2, SC-5, and SC-3	1.6 min.	0.3 min.	3.3 min.	5.2 min.

* Includes: Transfer of material from sample can to smaller container.
Heating sample to flowing temperature.
Weighing five cubic centimeter into test cup.
Assembling of apparatus.

TABLE IV — TIME REQUIRED FOR MAKING A FUROL-SAYBOLT VISCOSITY DETERMINATION

Material	Time to prepare one sample *	Time to test one sample	Time to clean apparatus	Total time
SC-2, SC-5, RC-2, RC-3	5 min. to 5 min. 57 sec.	3 min. 27 sec. to 12 min. 31 sec.	2 min. 49 sec. to 3 min.	11 min. 16 sec. to 21 min. 28 sec.

* Includes: Transfer of material from sample can to test container.
Heating test container to proper temperature.
Pouring sample into viscosimeter tube.
Allowing one minute for temperature adjustment.

by other methods, as the data on Tables III and IV show.

In comparison with Engler viscosimeter determinations, the saving in time is greater than that shown in the table.

The rise-in-capillary viscosimeter makes possible the testing of several samples in quick succession, thus increasing somewhat the saving in time shown in the tables. This is a factor which may be of interest to laboratories that have to handle a large number of samples in a relatively short time.

Offhand it may appear that the cleaning of the capillary tubes is a difficult matter. It will be found, however, that with the proper technique and with suitable solvents the tubes can be cleaned rapidly and thoroughly. Nitrobenzene and carbon tetrachloride have been found satisfactory for cleaning and acetone for drying the tubes.

Besides being fragile, the capillary tubes are the most expensive parts of the apparatus. However, it has been found by actual experience that a capillary tube will outlast several viscosimeter metal tips. The capillary tubes can be standardized readily.

After using for several years an instrument of the type described, the following conclusions have been reached.

1. The technique for making viscosity determinations with it is not particularly difficult.
2. Viscosity measurements can be made rapidly and with a degree of accuracy that shows a high order of reproducibility.
3. Since the amount of material required for the test is small, the need is eliminated of having to obtain large samples or of extracting large amounts of bituminous mixtures.
4. The instrument is easy to handle and easy to clean. It can be standardized readily.
5. The instrument is reasonable in initial and maintenance costs.
6. With its use, determinations are made in terms which permit expression of viscosity in specific instead of arbitrary units. This makes possible a direct comparison of viscosities of different materials as well as the making of correlations on sound bases.
7. Instruments of the type described are not suited to the measurement of consistency of materials which are not true liquids. A simple way of determining whether an instrument is suited to the measurement of consistency of a particular material at a given temperature is illustrated in Table I.

The State Highway Commission of Wisconsin, recognizing the advantages accruing with the use of scientific units for expressing viscosity, has included in its specifications since 1938 alternate requirements, expressed in poises, for viscosity of asphalt types MC, RC and SC and for tars. It will no doubt be realized that the measurements embodying the units that are specified can be made with instruments of a type other than that which has been described. This is a further advantage inherent in the use of scientific units in laboratory studies of the kind here described.

Federal Housing Decentralized To Get Speedier Construction

ACTIVITIES of the Federal Public Housing Authority are being decentralized into ten regions to obtain better programming and management and faster site selection and construction, according to a statement made by Herbert Emmerich, FPHA commissioner at the tenth annual meeting of the National Association of Housing Officials at Baltimore, May 13. In making this announcement Mr. Emmerich said: "But lest our regionalization become merely a new form of centralization in Chicago or Atlanta or San Francisco, rather than in Washington, we mean to use the facilities of local authorities to the utmost and to give them as much responsibility and authority as can be done under present conditions and existing legislation. The success of our decentralization will be measured by the extent to which you in the localities will feel yourselves able *not* to come to Washington with your problems.

"We shall give our regional directors much authority. In turn we will look to them to employ responsible contractors to do a finished job. These contractors will be encouraged whenever material and labor conditions warrant, to employ site or factory fabrication. We shall use any methods that will give us maximum speed and efficiency. But we in Washington will not try to buy houses wholesale before we have any idea on what site they are to be built.

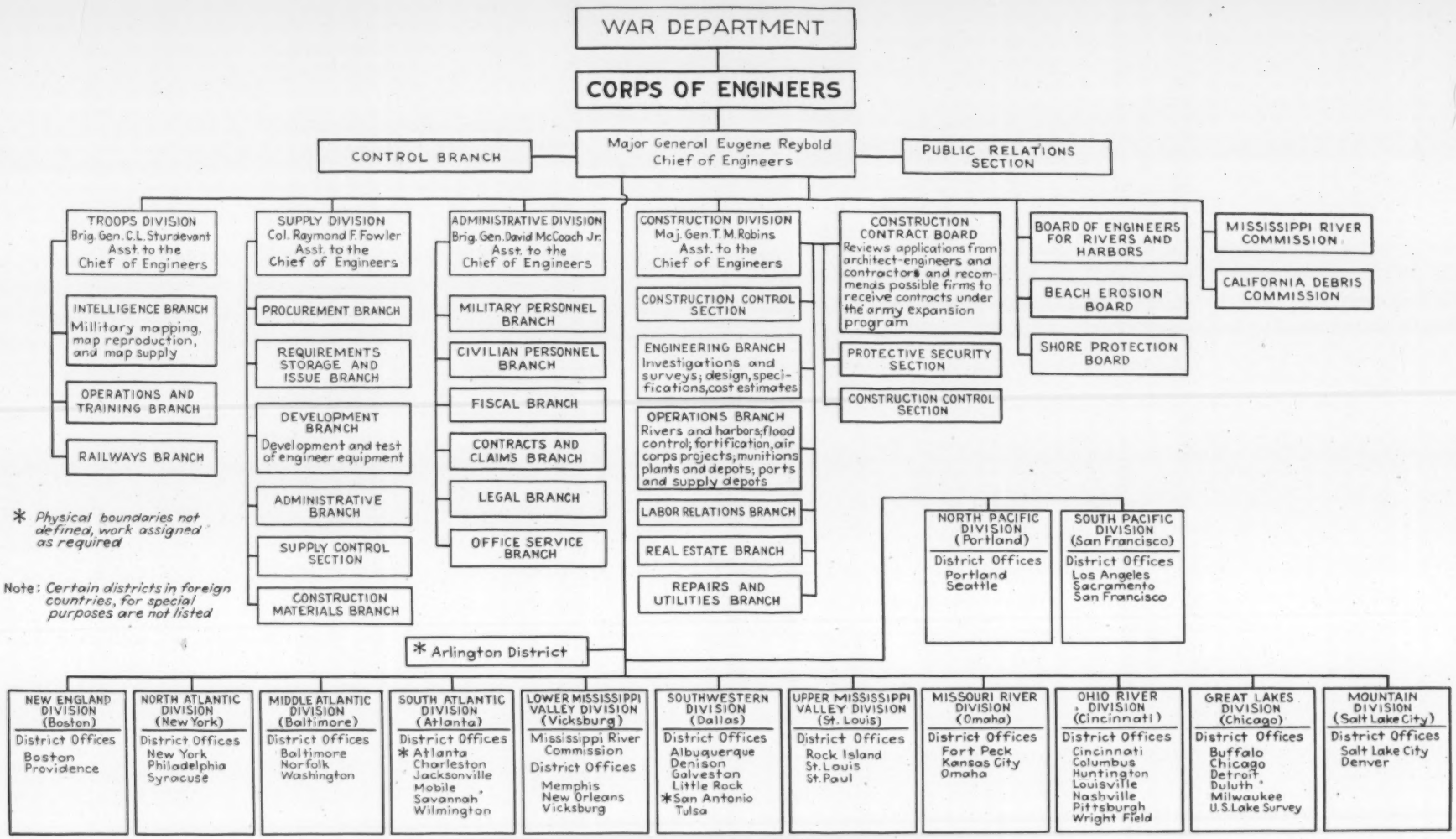
"How large is the war housing program? One answer may be 'as large, relatively, as the war production program,' for war housing must match stride for stride our production effort. As of the last week in April, the FPHA war housing program included a total of 1,011 projects containing 367,522 dwellings. Of these, 113,680 units were completed, 85,502 are under construction and the remainder are in the planning stage; prior to construction, sites and architects are being chosen, land is being purchased, plans and specifications are being drawn, and contracts for construction are being let. During April, contracts were awarded for nearly 22,000 units. These April construction contracts alone represent half of all the war housing provided in World War I.

"I feel obliged to say to you that we are woefully behind schedule in providing for the great army of migrating workers—workers who must be provided with shelter and decent human facilities if our Army and Navy and air forces are to be sustained and are to prevail. We must put five times as many houses under construction a month as under the slum-clearance program and finish them in a third of the time. Without decent, healthful shelter there will be terrific labor turnover.

"The gravity of the situation is further emphasized by three factors: shortage of materials, lack of transportation, and lack of public recognition of the human facilities and standards needed to preserve high production rates and faster schedules.

"The shortage of materials for new construction is increasing monthly. To talk of priorities has become almost academic at a time when there are less nails being made than we used each month and in a month when lumber of certain types cannot be had even at its source in the Pacific Northwest, when there is not enough copper for strictly military requirements, let alone essential civilian ones, and when the demand for steel necessitated a general limitation order.

"I am glad to say that the seriousness of this complex problem is recognized in high quarters of the War Production Board."



ORGANIZATION CHART OF THE CORPS OF ENGINEERS, U. S. ARMY

Corps of Engineers Create New Divisions

THREE NEW DIVISIONS of the U. S. Engineer Department have been created within the Corps of Engineers, U. S. Army, to take care of the increased activities resulting from the transfers to the Corps of Engineers of practically all construction operations of the U. S. Army. The new divisions are the New England Division, Middle Atlantic Division and the Mountain Division. Establishment of these new divisions marks the culmination of changes that have been in progress since January, 1941, when the Gulf Division was abolished and its district offices were allocated to adjoining divisions. Early this year new district offices were created at Arlington, Va., Atlanta, Ga., Columbus, Ohio, Salt Lake City, Utah, and San Antonio, Texas.

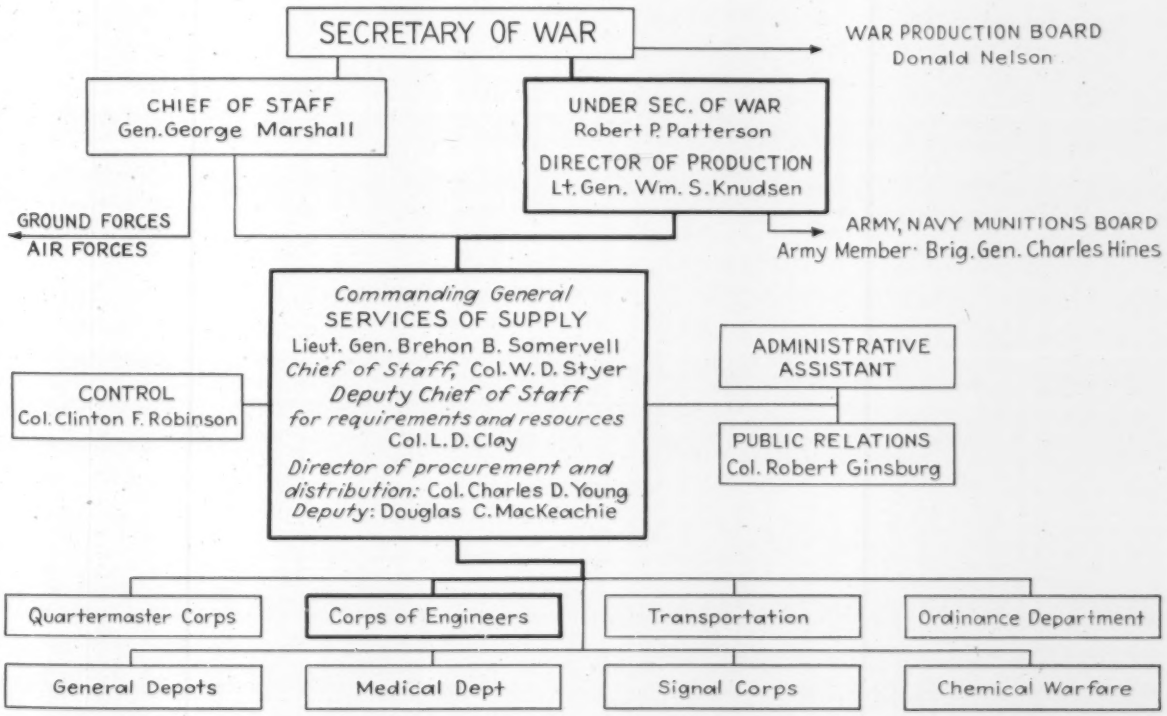
The New England Division, with headquarters at 75 Federal St., Boston, takes over the activities of the Boston and Providence districts, formerly in the North Atlantic Division. Headquarters for the Middle Atlantic Division have been set up at 101 East Fayette St., Baltimore. This division includes the former Baltimore, Norfolk, and Washington district offices.

Headquarters for the South Atlantic Division were moved to 55 Whitehall St., Atlanta, Ga., some time ago. Headquarters for the Missouri River Division have been moved from Kansas City to 19th and Douglas Sts., Omaha, Nebr., and headquarters for the Great Lakes Division have moved from Cleveland to 332 South Michigan Ave., Chicago.

The new Mountain Division has headquarters at 36½ West Second, South, Salt Lake City, Utah. It has district offices at 32 Exchange Place, Salt Lake City, and a new Denver district office with permanent headquarters yet to be established.

Under the War Department reorganization, begun last winter (*ENR* Dec. 11, 1941 p. 848), all construction operations formerly carried out by the construction division of the Quartermaster Corps were transferred to the Corps of Engineers. That reorganization resulted in segregation of activities of the Corps of Engineers into four main divisions, the extensive construction operations brought over from the Quartermaster Corps being put in the Construction Division along with the river and harbor work, flood control and other peacetime activities of the U. S. Engineer Department. A large amount of airport construction also is now being carried out under the direction of the division offices. The other divisions are Troops, Supply, and Administrative.

Reorganization of the Army early in March of this year segregated all activities into three main divisions, the Ground Forces, Air Forces, and Services of Supply. Lieut. Gen. Brehon B. Somervell, an engineer officer, is head of the Services of Supply. All operations of the Corps of Engineers, other than those of the engineer batallions that make up a part of each combat division, come under the Services of Supply, as indicated in the diagram below.



The place of the Corps of Engineers in the recently created Services of Supply, one of the three main elements of the reorganized U. S. Army, is shown in this diagram. For a further breakdown of the activities of the Corps of Engineers, see the diagram on the facing page to the left.

Fig. 1. Concrete is delivered in transit-mix trucks, hoisted by tower or crane and distributed by concrete buggy.

Concreting a 100-Acre Office Building

***Contents in Brief**—Early dredging of what is to be a scenic lagoon to permit water delivery of aggregates, transit-mixing of concrete because of the huge area over which it must be spread, and concrete delivery by tower hoist and chute to concrete buggies for final placing are highlights of the concrete construction for the War Department Office Building in Arlington, Va. Forms are pre-assembled and marked for definite locations. Special forms of 1x8 boards with rounded edges are used to make an architecturally rough effect on exposed concrete faces. A special service organization, which has developed a rapid method of moisture determination, is employed to exercise complete supervision over the concrete batching.*

WHAT IS BELIEVED TO BE the world's largest office building, so huge that access demands a 40-ft. wide driveway around the interior of the structure, is under rush construction for the War Department in Arlington, Va., just across the river from Washington, D. C. Now spoken of as the War Department Office Building but probably to be known as the "Pentagon," it is a five-sided structure nearly a mile around with each exterior wall 921.6 ft. long and a pentagon-shaped inner court with each side 360.8 ft. long. The building, three and four stories in height, will provide about 4,000,000 sq.ft. of gross office space and an additional 600,000 sq.ft. of storage area. Light courts above the first floor divide each of the 386-ft. deep wings into five rows of offices with good natural light.

Started last September with a $32,000,000 authorization, the building was expected to house all War Department offices in Washington, but even now its adequacy is doubted. The structure is adjacent to the old Washington airport, that field being raised and landscaped to provide parking areas for the anticipated 8,000 cars of the 25–30,000 people expected to work in the structure. Exterior walls are limestone faced but those on the inner court and the light courts will be of exposed architectural concrete. The building rests on 42,000 concrete piles, cast-in-place in driven metal shells.

Construction of the building requires the placing of 450,000 cu.yd. of concrete and the use of more than 20,000,000 b.ft. of lumber, largely for temporary construction. The method of mixing and placing concrete and the details of the forms may be readily adapted to other concrete structures needed to speed the war effort. For that reason this article will be confined to a description of these parts of the construction operations.

3,000 cu.yd. of concrete daily

The plant to supply concrete for the project is planned to batch material for 3,000 cu.yd. of concrete daily, feeding the material directly into batch-trucks for mixing enroute to its place in the structure. Aggregate used is produced by a floating sand and gravel dredge on the Potomac River and is delivered best directly to the work in the barges in which it is originally loaded. Barge delivery was desired at a point several hundred feet inland from the shore but near an

area where a lagoon will eventually be part of the permanent landscaping of the building grounds. The excavation of this area was rushed with land equipment which operated to the full depth of about 14 ft. below the normal high-tide level of the Potomac but behind a clay dike left around the basin and protected, to some extent, by wellpoints. After completion of the excavation inside the area a dipper dredge opened a passage through the dike for passage of loaded boats. Elimination of the rehandling of aggregates and transporting them to a point where rail delivery of bulk cement is practical is estimated to have saved 35 c. per cu.yd. of concrete as well as reduced the length of haul required for more than a million tons of concrete.

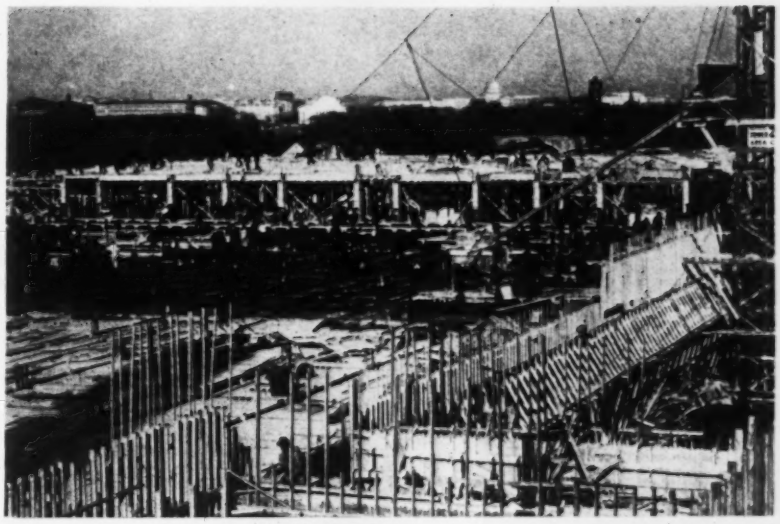


Fig. 2. Most concrete for the structure is raised by 1 to 1½ cu.yd. tower hoists and chuted to small hoppers for final distribution by buggies.

Two stiff-leg derricks, equipped with clamshell buckets, unload a total of 5–600 cu.yd. of aggregates per hour feeding it through a receiving hopper onto a radial stacker. The stacker is a 24-in. wide 185-ft. long belt conveyor rotating about a point under the receiving hopper and traveling on a semicircular track under about the middle of the conveyor length. Aggregates go into a stockpile from which they are drawn, through gates in the top of a buried timber tunnel, to a reversible belt conveyor. This conveyor feeds either sand or gravel to either of two inclined conveyors that carry the material to two individual bins under which weighing batchers are located. One of the batchers is capable of handling material for 200 cu.yd. and the other for 100 cu.yd. of concrete per hour in 4-cu.yd. batches. All materials, including water, are weighed, and batched directly into the mixer drum, with only water for washing out the mixer put into the tanks on the truck-mounted machine.

Cement comes to the job in hopper bottom bulk delivery cars and is carried into a cement bin by two separate bucket elevators, thus giving the plant two completely independent aggregate handling devices to assure against interruption in the flow of material.

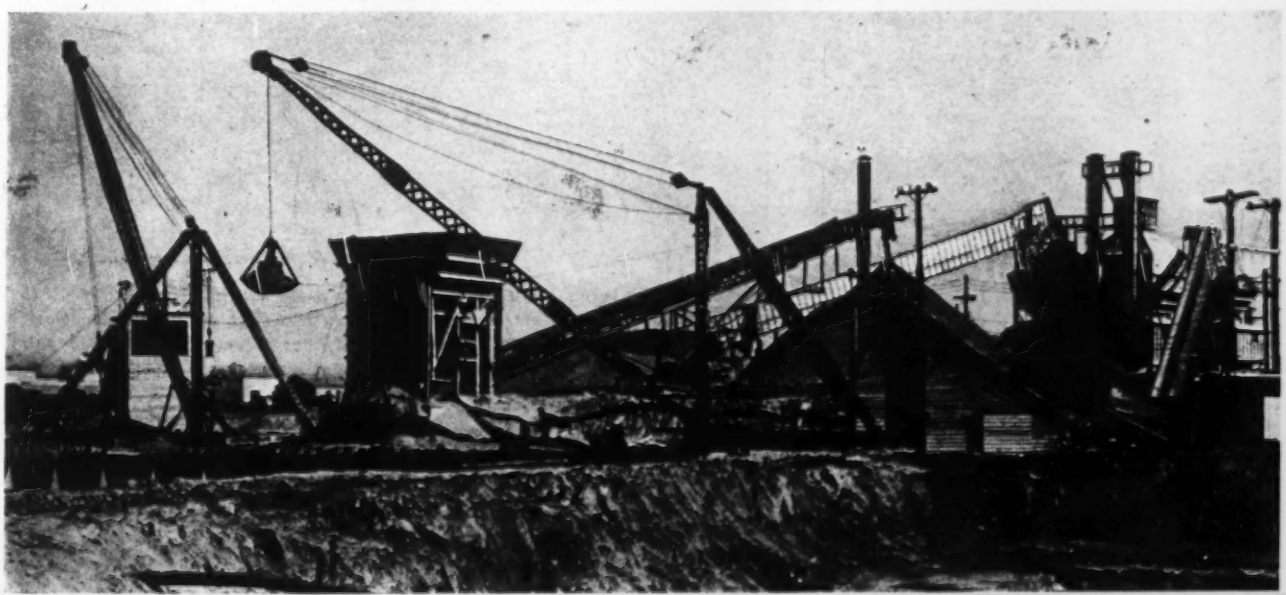
Moisture determination by machine

Accurate and practically automatic determination of the surface moisture carried by each size of agregate is made by a displacement method using specially designed and very accurate scales. At frequent intervals, samples of the sand and coarse aggregate are tested for moisture by partially filling a fixed volume container with water and sifting into it a known weight of the aggregate. Water is then added to fill the container exactly and a special moisture meter scale is used to determine the percent of free moisture, which it is said to do with an accuracy of about one-fourth of one percent by direct reading on the large dial scale.

The moisture tests require less than one minute and are usually made by an experienced technician but are so simple that they can be made by the weighman if necessary. The same scale is arranged to give a quick, single reading determination of the specific gravity of the material, which must be known, and occasionally checked, for use in the moisture determination.

Compensation for the moisture in the aggregate is made automatically on the special batching scale, which is a full dial scale having a separate beam and poise for each ingredient,

Fig. 3. Aggregates come to the site by barge, are unloaded by stiff-leg derricks and stockpiled by a radial stacker. Belt conveyors carry aggregates to the tops of batcher bins while bulk cement, delivered by rail in hopper bottom cars, is carried to a separate bin by bucket elevator. All materials and water are batched into 4-cu.yd. truck-mounted mixers.



including water. Each aggregate that carries free moisture is assigned to a special scale beam equipped with a compensating type poise so designed that by adding small disks, calibrated in percents, its weight can be increased by any desired percentage. Thus when a poise is set to the weight of dry material required and disks totaling the percent of surface moisture carried by the material are added, the dry weight plus the weight of the contained moisture will be shown on the dial. The proper bin gate is then opened and, as the material enters the weigh hopper, the scale indicator moves backward until it reaches zero when the correct amount of material will have been weighed into the batch hopper. After each of the ingredients has been weighed in this manner, the poise assigned to water is set at the total weight of water required for the batch and the percentage disks previously added to the sand and gravel poises are removed. This automatically deducts the amount of water carried by the aggregates from the total water required, leaving only the net amount to be added which will show on the scale dial. The water is weighed into a separate compartment of the hopper. Cement is also weighed on the dial scale. A graphic recorder attached to the scale head makes a permanent record of the amount of each ingredient in each batch and indicates the time it is weighed out.

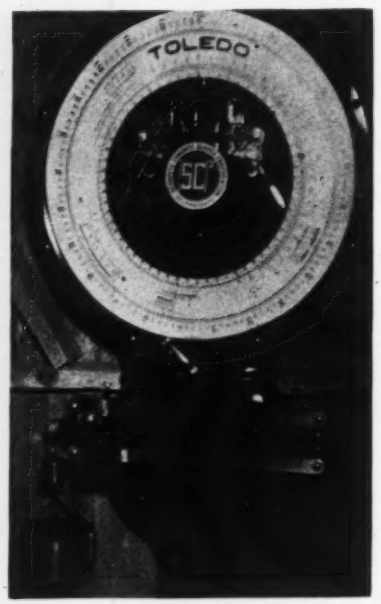


Fig. 4. A rapid method of moisture determination employs a scale on which free water in aggregates can be read directly.

One make of mixers and trucks

The truck-mixers in use on the work each mix and haul a 4-cu.yd. batch of concrete. One or two larger mixers are in use but they are loaded only to the 4-yd. capacity to speed loading and eliminate the possibility of error in changing from one set of weights to another. The subcontractor for the concrete has found that for his use in Washington the 4-cu.yd. trucks are most satisfactory. Smaller ones do not get the production over a day's operation and larger ones are more likely to be stuck or delayed so that the average day's work is little better than for 4-cu.yd. mixers but costs are higher. This owner has also concentrated on one make of truck and mixer because he can reduce the stock of parts that is necessary to carry, and drivers and repair men can work on the units with a minimum of confusion or instruction since changes in models are much less confusing than changing to an entirely different machine with levers and gadgets located in different places.

The mixers are equipped with separate power units and almost always mix as they haul to the work, thus saving time. Concrete in the footings is placed by direct discharge from the mixer or by crane and bottom-dump buckets as conditions require. Most of the concrete for the structure is raised in 1 to 1½-cu.yds. tower hoists with an automatic dumping bucket that discharges the concrete into a suspended chute. Chuting is not used directly to the forms but

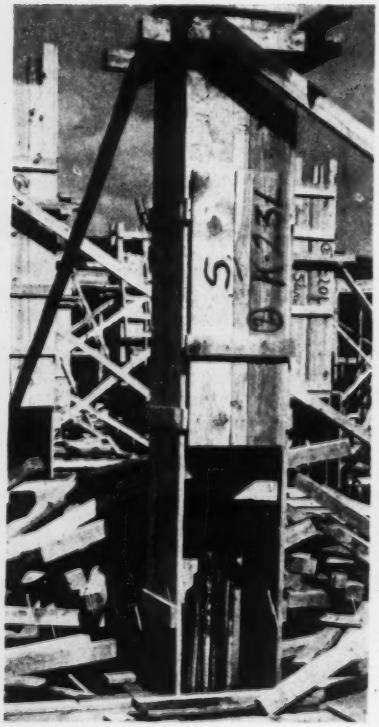


Fig. 5. Column forms are reused many times. Note identification marks (with S for South and W for West) and large opening to adjust and tie column steel as well as permit cleanout of the forms. Right: Beams vary in depth but not in width. Nailing strips (held by duplex head nails) on beam sides carry 3x4 timbers to support 1x8 S1S1E panel floor-slab forms.

rather for short distance transportation to a small hopper from which concrete buggies are filled to make the final distribution. In some cases concrete is hoisted to the lower floors by cranes and bottom-dump buckets, with distribution also made through small hoppers and concrete buggies. Regular trucking roadways are arranged to speed the passage of trucks to the foot of the tower hoist and temporary roadways are provided, when necessary, to reach other places.

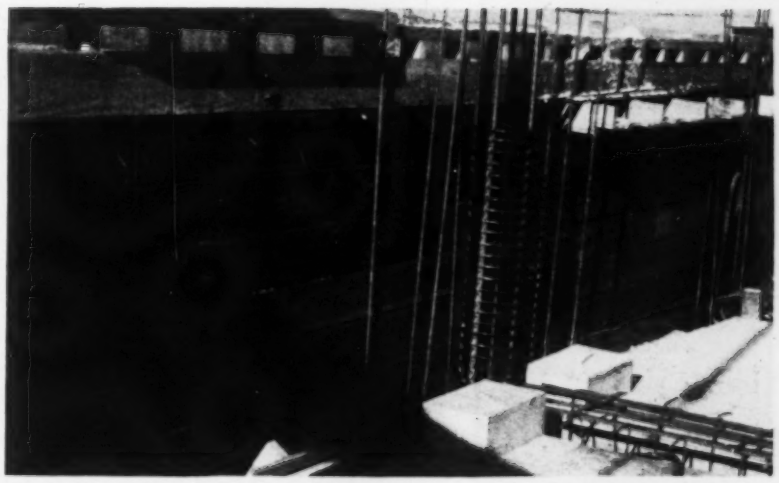
100 acres of slab forms

The huge building requires the use of more than 20,000,000 b.ft. of lumber, nearly all in temporary construction and much of it in forms for the reinforced-concrete columns, walls and floors. Wood forms are used with as many of them as practical arranged in pre-assembled sections and planned for many reuses.

Columns are at 20-ft. centers each way and are square. The forms for their construction, Fig. 5, are designed for several uses on each of the floors and are pre-assembled and carefully marked for the location to which they are adapted. It may be noted that these forms are notched at the top for the beams and that a single wood collar at the top and bottom of the form hold it in position. The large removable piece makes it easy to set and space the column steel and permits easy cleanout just ahead of the concrete. When the form is ready for concrete, conventional column-clamps are set to tie the form, but these are held at the one location only the minimum time required for placing and setting the concrete to reduce the number of clamps necessary on the job.

The beam bottoms and sides are erected next with nailing strips carried on the sides of the beams to support 3x4's which, in turn, carry the floor slab forms. The column, beam and slab forms are all made of SIS1E material to be reasonably free from uneven areas but with a surface rough enough to hold the scratch coat of plaster. The slab forms are 1x8 pieces assembled in panels with batten strips holding them together. Loose boards are laid out to supplement the panels where necessary.

The columns and slab forms are set at the same time, then reinforcing for the columns dropped in from above and the columns concreted in advance of the other work. Column reinforcing is spiral hoops with vertical bars. Where the complete cage is light enough to be handled manually it is assembled before use, otherwise the spiral steel, with spacer bars attached, is dropped into the columns and the verticals placed one at a time and tied at the bottom through the large opening in the side of the form. Concrete is wheeled over the slab form to fill the columns.



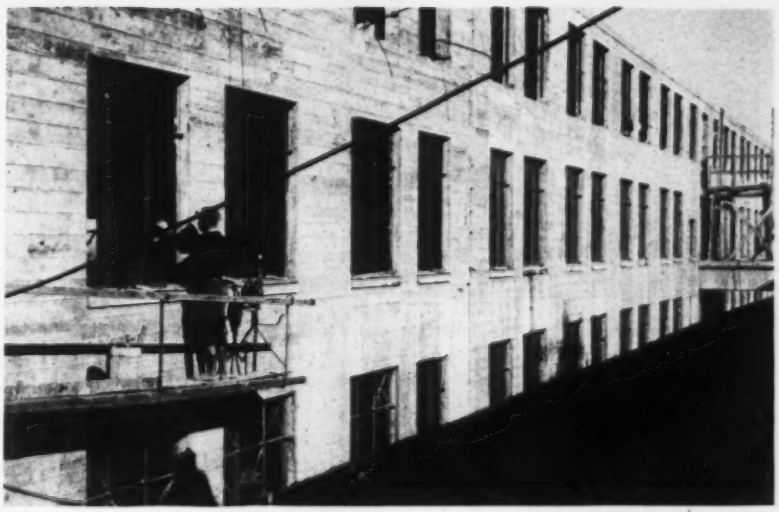


Fig. 6. Forms for architectural concrete, (above) and (below) the concrete after the forms are stripped. Limestone facing is used on the exterior but the treatment here shown is standard for the huge interior court and light courts.

Beam and slab reinforcing is then laid and a 5½-in. thick slab of 2,500 lb. per sq.in. compressive strength concrete is placed to carry a 150 lb. per sq.ft. live load. Special frames, set through the reinforcing, are supported on the form to carry one end of each of two runway mats on which carts are run to distribute the concrete.

Flexible-shaft internal-type vibrators are used for compacting the concrete. After some leveling by hand, the fresh concrete is struck off by screeds operating over special strips set to the floor level and the floors are finally finished with a powered rotary trowel and floor finisher. During cold weather the curing and hardening processes were speeded by the use of vacuum mats to remove excess moisture and laitance from the surface of the concrete.

Architectural concrete

Forms for the concrete to be left permanently exposed are rough on the side facing the concrete with the edges carefully rounded to produce projecting fins on the surface as may be seen in Fig. 6. This treatment is used on the interior court of the Pentagon and on each of the light courts which divide each side of the huge building into five parallel lines of offices. Forms for the vertical walls are built in place, using long vertical

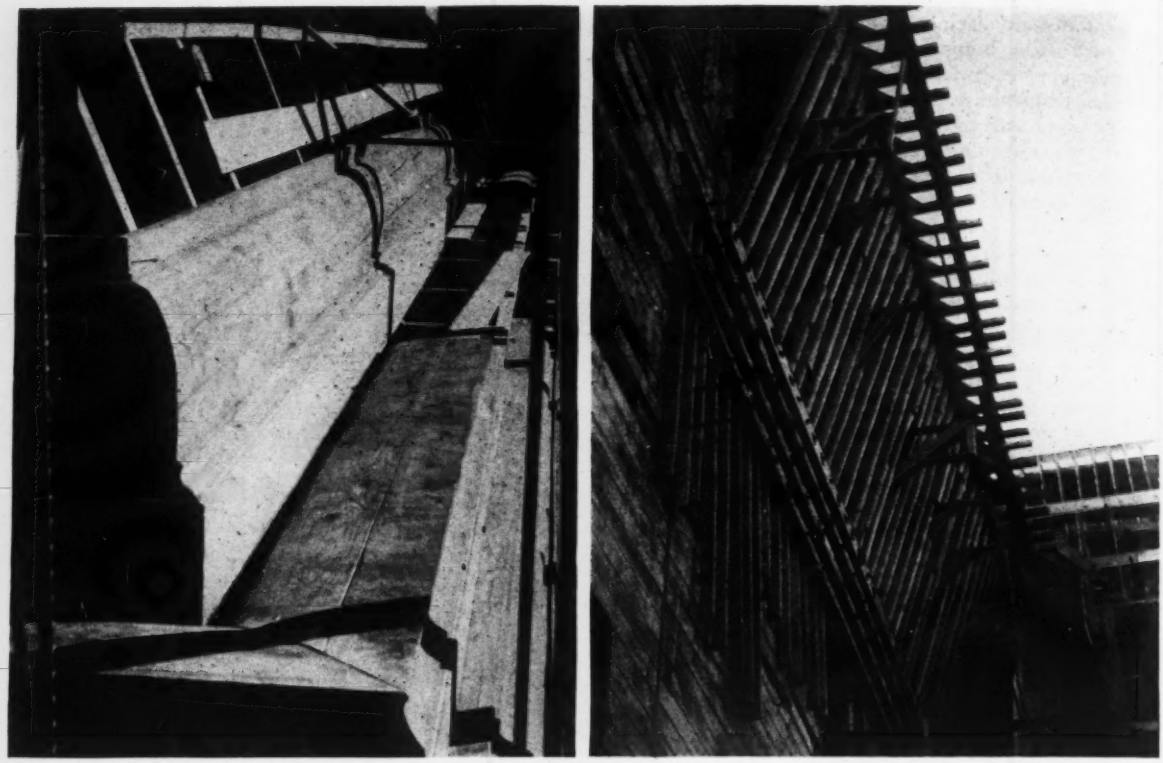


Fig. 7. Detail of bracketed form for the overhanging cornice. At right is the supporting bracket bolted to the wall.

studs to which the special form boards are tacked. Horizontal wales and easily breakable wire ties are used for the walls with stripping being done progressively from below as the form is added to above.

The War Department Office Building is being constructed under the direction of the Corps of Engineers, U. S. Army. Immediate supervision of the work comes under a specially created Arlington District of the Corps of Engineers for which Lt. Col. Clarence Renshaw is district engineer, assisted by a small staff of Army officers. The collaborating architects have been under the direction of G. E. Bergstrom.

General contractors for the work are the combined firms of John McShain, Inc., Doyle & Russell and Wise Contracting Co., Inc. For this organization J. Paul Hauck is superintendent in general charge of the project; Tom Moore and D. A. Davis are assistant general superintendents.

Howat Concrete Corp. furnishes the concrete, mixed and delivered wherever directed by the general contractor. The Scientific Concrete Service Corp. supply and service the special batching and moisture determination scales, and assist the engineers to make all necessary moisture and materials adjustments to produce the concrete desired.

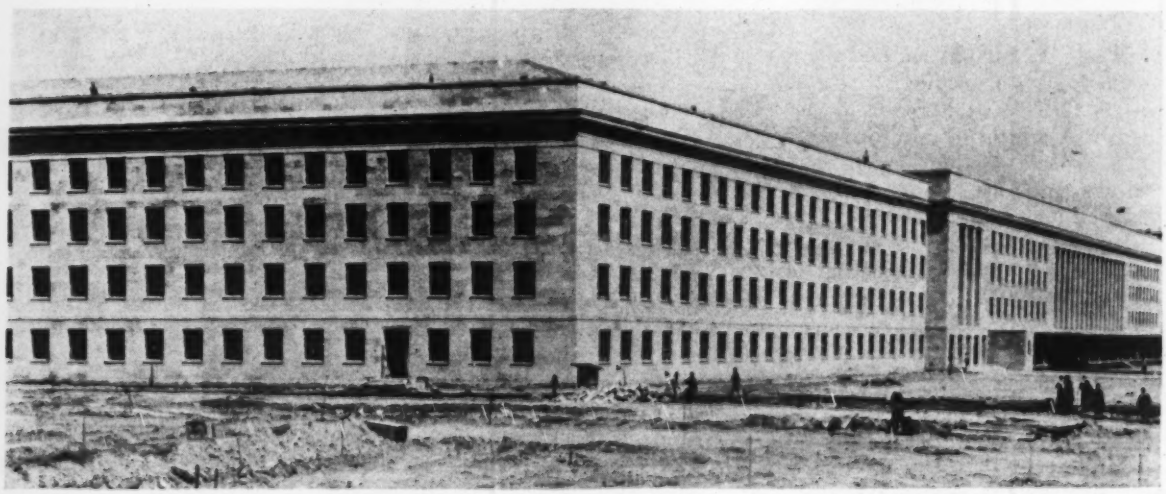


Fig. 8. The completed structure provides about 4,000,000 sq.ft. of gross office space, and about 600,000 sq.ft. of storage area. Each of the five exterior walls is 921 ft. long.

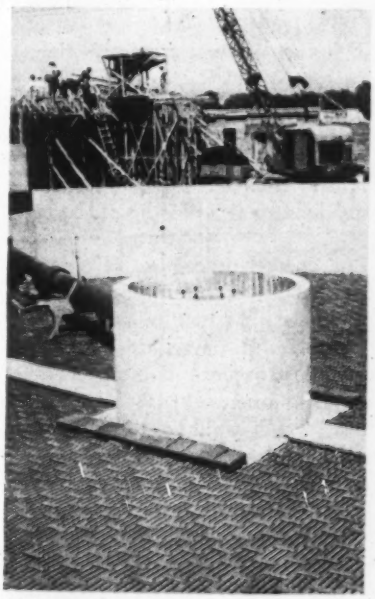
Unique Sewage Plant For War Office Building

Contents in Brief—High-rate filters were chosen for a sewage treatment plant, which will function at full capacity only nine hours daily.

SOMETHING UNIQUE in sewage disposal installation is the treatment plant designed to handle a 9-hr. flow from the new War Department Office Building and the adjacent military reservation in Arlington, Va. Now nearing completion, the plant will provide facilities for complete treatment of sewage from that building and the reservation. The plant was designed for an occupancy of the building and the adjacent military areas during the working day only, six days a week.

No precedent for a plant of this kind existed and the design represented, therefore, an opportunity for original planning. This was supplied in large part by Charles R. Velzy, works superintendent of the Buffalo Sewer Authority, who served as special consultant under the direction of G. E. Bergstrom, chief architect for the project. Mr. Velzy was at one time designing engineer for Greeley and Hansen, consulting engineers of Chicago.

Because the plant is located on the Potomac River at a point opposite Washington, D. C., it was considered essential to provide complete treatment for the sewage. For this purpose high-rate trickling filters were chosen. Chlorination equipment will be installed for emergency needs (if it should be necessary to by-pass the plant) and for possible odor control, but continuous chlorination is not believed to be necessary. Sludge will be digested and then dried on sand beds. Other facilities include pre-aeration tanks, preliminary sedimentation units and final settling tanks.



Distribution head and floor system of the high-rate filters.

Preliminary studies indicated that a flow of 30 gal. per capita was a conservative assumption. A maximum population of 40,000 was assumed within the entire area to be served by the plant. On this basis there would be a total flow of 1.2 mgd. and a design rate of 3.2 mgd. for a nine-hour period; it was estimated that the peak flow would be 8 mgd.

It was assumed that the suspended solids content of the sewage would be 0.14 lb. per capita per day, or 570 ppm. The biochemical oxygen demand (5-day) was rated at 400 ppm.

A large amount of grease is anticipated from the kitchens and cafeterias that are required for the noon-day meal service, and for this reason pre-aeration facilities were added.

Design data on units

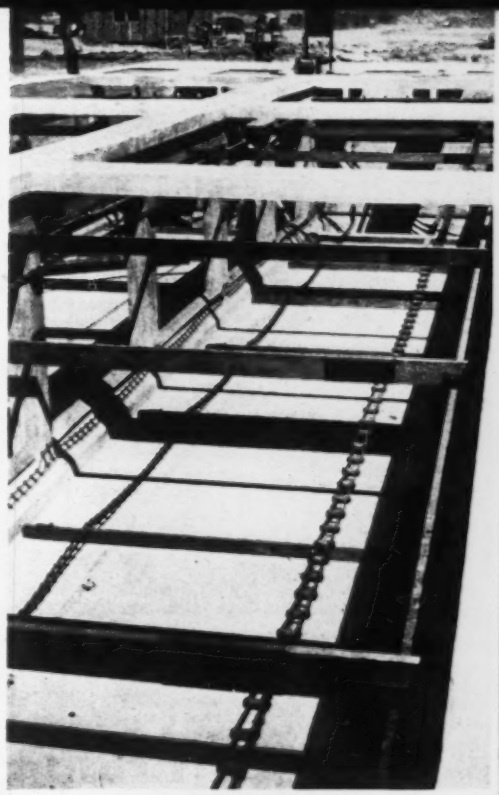
The plant units and their essential design features are as follows:

Pre-aeration Tanks—Two units, each 10 ft. deep, 10 ft. wide, and 31 ft. long. Air will be forced through tube diffusers at the rate of 130 cfm. The average detention period will be 30 min.

Sedimentation Tanks—Two rectangular units each 10 ft. deep, 31 ft. wide and 90 ft. long provided with mechanical sludge collectors and skimmers. Average detention period is 3 hr.

Filters—Two units, each 85 ft. in diameter and 6 ft. deep provided with rotary distributors. It is intended to operate these at a dosing rate of 10 to 25 mgd. Facilities are provided for forced ventilation.

Final Settling Units—Two rectangular units each 8 ft. deep, 31 ft. wide, and 90 ft. long, provided with mechanical sludge scrapers. Average detention period is 2.25 hr.



Sludge collectors are installed in the settling tanks while the balance of the plant is rushed to completion.

Sludge Digesters—Two tanks each 50 ft. in diameter and a side wall depth of 20 ft., provided with floating covers, gas collection equipment and heating coils. Tank capacity is such as to provide 3 cu. ft. per capita, on an equivalent population basis. The latter basis is determined by assuming that the average municipal plant receives most of its load of solids in 16 hr. whereas this plant will get its load in a period of only nine hours. The equivalent population is therefore nine-sixteenths of 40,000, or 22,500.

Sand Drying Beds—Four units each 28 ft. 4 in. x 112 ft., furnishing a total area of 12,600 sq. ft. The beds are covered with glass enclosures.

Contractor and direction

General contractor for the plant is John McShain, Inc., Doyle & Russell, and Wise Contracting Co. Construction is well underway, and the treatment plant will be ready for operation in May, when the initial occupancy of the office building will begin.

The project is under the direction of Lt. Col. Clarence Renshaw, district engineer, Arlington, Va.

Fig. 1. Scranton Bridge built over a river and two railroads with highway and railroad traffic maintained at all times.

Major Bridge Replacement Under Traffic

A. Burton Cohen
Consulting Engineer, New York, N. Y.

***Contents in Brief**—The compelling problem in replacing an existing three-span, through-truss highway bridge over the Lackawanna River and two railroads at Scranton, Pa., was to maintain continuous service on the line of the existing structure, and without interfering with railroad operations, during all stages of the new construction. The plan evolved kept one-half of the old structure in service while the other half was removed and rebuilt; traffic was then shifted to the new construction to permit the reconstruction of the second half of the bridge.*

THE IMPORTANCE of Lackawanna Ave., one of the principal thoroughfares in the heart of Scranton, Pa., led to a unique and original correlation of bridge design and construction to meet traffic requirements. Within a few blocks of the business center of the city, Lackawanna Ave. was carried over the Lackawanna River, the Delaware and Hudson R.R. on the southerly bank and the Central R.R. of New Jersey on the northerly bank, on a three-span, through-truss structural steel bridge built in 1909. The trusses, set along the curb line, supported a 38-ft. roadway and two 8-ft. cantilevered sidewalks.

The concrete for the sidewalks, which are supported on structural steel brackets, was poured in full contact with the truss members which penetrated the sidewalks. In the shrinkage of this concrete a slight crevice was formed around the periphery of the embedded members where water collected unnoticed and caused a rapid deterioration of the steel. In many of the vertical truss members the rusting action, which took place just below the sidewalk surface, caused a section reduction from 50 to almost 100 percent. Heavy plate-and-angle floorbeam hangars, attached to the inner face of the vertical truss members and extending above the deteriorated sections, bridged the gaps to prevent complete collapse of the structure.

When the weakened condition of the bridge was fully realized, steps were taken immediately to reinforce it. All traffic excepting pedestrian was temporarily detoured and street-car service maintained by transfer and stopping at either end of the bridge. The paving and concrete floor were removed to lighten the dead load, and plates and angles were welded over the section of the trusses reduced by deterioration. With these precautionary measures completed, it was found safe to permit the operation over the bridge of a single street car per span and vehicles of two-ton loading on the other half of the crossing. The repairs, which cost about $4,000 and required a month's time, were part of a scheme to maintain traffic on the line of the structure during all stages of the reconstruction. The roadway width and the curved approach from the south were additional inadequacies of the old structure.

The normal procedure, of course, would have been to reroute all traffic, tear out the old structure and build a new bridge. However, this was unsatisfactory because of the necessity for maintaining: (1) the street-car service, which could not be detoured; (2) the fire equipment and other emergency traffic movements; and (3) restoration of regular traffic as quickly as possible. Much inconvenience would follow any plan calling for the detouring of pedestrian traffic, and no interruption of service on the two railroads was permissible.

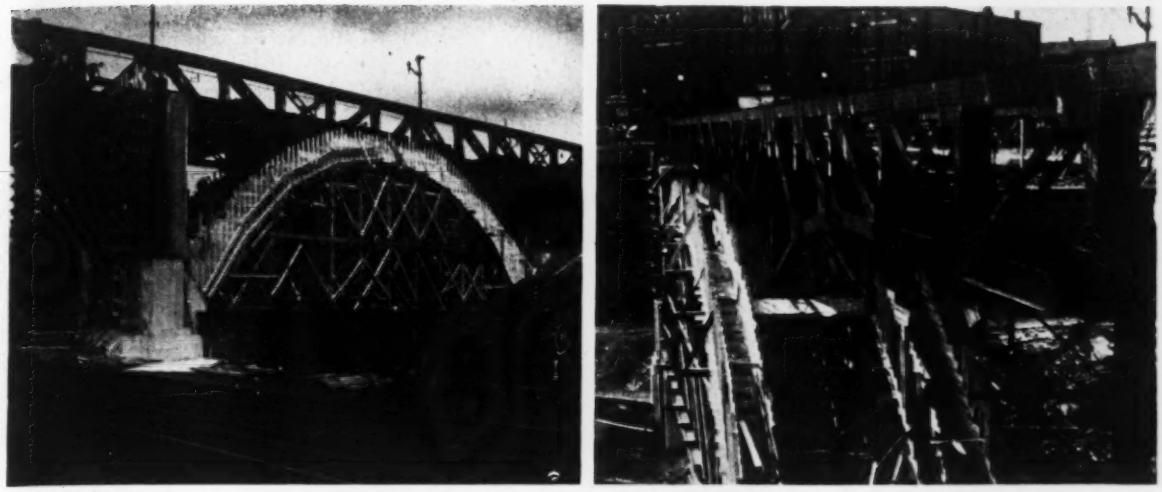


Fig. 2. After the existing pier had been enlarged by encasement to act as the south abutment for the arch span and the new abutment built in the railroad embankment, the falsework for the four ribs was erected.

These requirements, which placed severe limitations on the type of bridge that could be built, were ingeniously fulfilled by the construction of a reinforced-concrete, 97½-ft. multiple-arch-rib center span, built underneath the existing bridge and complemented by two 61-ft., I-beam end spans over the railroads. The overall length of the new bridge, which is designed for a H-25 loading, is 253 ft.; a 44-ft. wide roadway and two 8-ft. sidewalks are provided. Plans and specifications called for a definite schedule or sequence of construction.

Two stages of construction

In general, the order of the work called for the construction of the bridge in two stages comprising one-half of the bridge's width in each stage. Traffic was to be maintained first over the westerly half on a temporary timber plank flooring laid by the city over the exposed floor plates while the easterly half was removed and reconstructed. The removal of one-half of a through-truss bridge while traffic is carried over the other half called for a temporary support of the used portion.

The center span of the old bridge and part of the span over the C.R.R. of N.J. were supported from four slender arch ribs built under the old structure. The longer the arch span, the greater the length of the old bridge floor that could be supported by concrete columns built up from the arch ribs to the under side of the floorbeams to effect a two-point, intermediate support. The span, however, was limited by the railroad right-of-way requirements at the north end, which were fixed for four-track capacity calling for a span of approximately 61 ft. On the span over the C.R.R. of N.J. it was possible, therefore, to use an I-beam span.

A new abutment-pier for the arch ribs was necessary alongside the railroad to reduce the span over the tracks to 61 ft. This abutment-pier was built in the railroad embankment, which is composed of culm and ash, and was carried down 44 ft. to bedrock. An investigation revealed that no sub-surface coal-mining operations encroached upon the area of the bridge, precluding any settlement and making possible the construction of a rigid structure.

The 61-ft. span over the D. & H. R.R. could rest on the existing pier at the inner end, once it was enlarged by the concrete encasement to form the necessary arch abutment. The other end rested on the existing abutment.

The concrete arch ribs, braced by horizontal ties, function together in pairs, and each pair straddled a truss of the old bridge, as shown in Fig. 2. The centering forms for the outside ribs cleared the old bridge after the

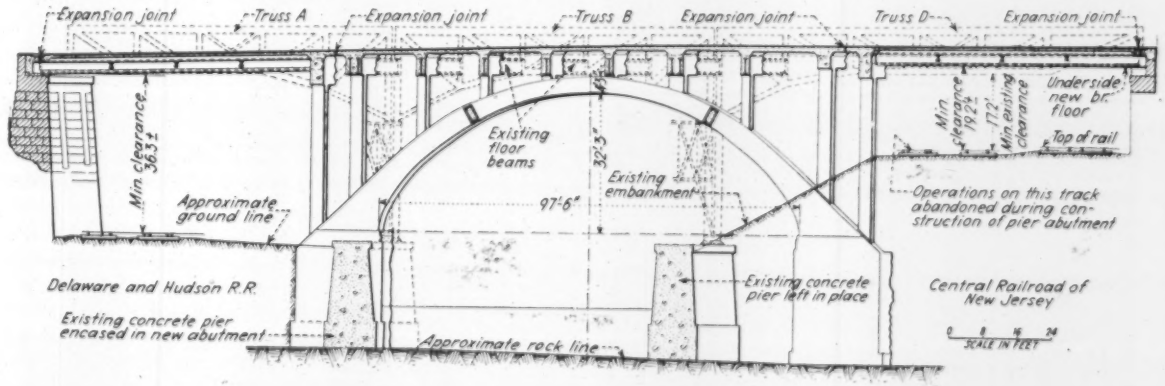


Fig. 3. A longitudinal section through the east half of the new bridge (solid lines) illustrating how the west half of the old structure (dotted lines) was kept in service during construction of the east half of the new bridge. Note how the arch ribs extend through an existing steel-frame bent.

cantilever sidewalks were removed. However, the forms for the two interior ribs were built through the bracing of the column bent support of the old bridge adjacent to the C.R.R. of N.J., as shown by Fig. 2, which also shows the timber arch centering supported on four I-beams that were subsequently used in the bridge's permanent floor. The beams for the falsework were supported on the new abutments at the one end and the northerly pier of the existing bridge at the other end. It is to be noticed (Fig. 3) that the concrete bent supporting the one end of the new I-beam span over the D. & H. R.R. was built under and through the end panel of the old bridge truss.

All the concrete for the arch abutments was placed by a bucket handled by a truck crane operating along the railroad embankment, while the concrete for the ribs and other parts of the superstructure was supplied by a small mixer located on the old deck and dumping into chutes or by a crane also operating on the deck of the old bridge.

With the old floorbeams above the arch span supported on the concrete spandrel columns, the steel trusses on the east side were removed, and the floorbeams so supported made a part of the new structure (Fig. 5). After the paint and rust were thoroughly removed, the floorbeams were then encased in concrete and extended in a reinforced section to give bearing on the facia rib. In order to cut away the first half of the old bridge over the railroads, the floorbeams at those points were suspended along the center line of the bridge from a 30-in., 172-lb. steel girder in each of the end spans (Fig. 5).

The inner ends of the girders were supported on the old floorbeams already made a part of the arch span and the outer ends rested on the stone retaining walls forming the existing abutments. The length of the span over the C.R.R. of N.J. made necessary an intermediate timber column support placed between the tracks so as not to interfere with railway traffic. No intermediate support was necessary over the D. & H. R.R. With the old floorbeams thus supported, the entire easterly half of the bridge was removed and the first half of the new structure was completed, as shown in Fig. 7.

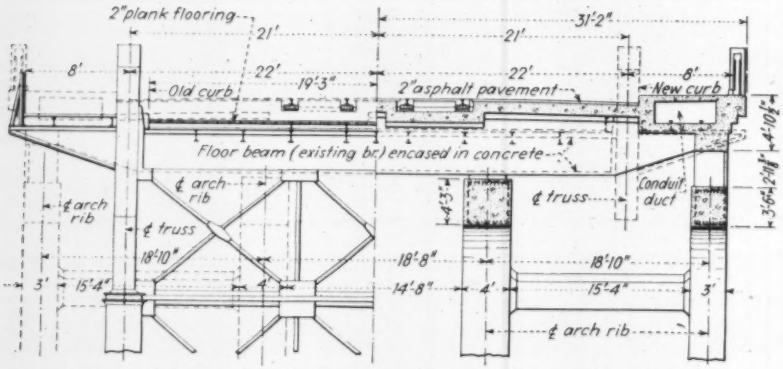


Fig. 4. With the four arch ribs completed, the spandrel columns over the inner ribs were built to support the existing floorbeams that were to be incorporated in the new structure. Right side of drawing shows east half of new bridge as solid lines and old structure as dotted lines, and vice versa on the left. Elimination of the old trusses along the curb lines made it possible to increase the roadway width from 38 to 44 ft.

Fig. 5. The floorbeams of the old bridge over the arch ribs supported on the spandrel columns and the westerly half of the floorbeams beyond the arch and over the railroads are supported by suspenders from a temporary I-beam girder placed along the center line of the bridge. This arrangement permitted removal of one-half of the existing structure and maintenance of traffic on the other half.

Composite deck for end spans

The longitudinal floorbeams of the spans over the railroads were composed mostly of 30-in. beams varying in weight from 108 to 172 lb. They were placed on 5-ft. centers, except near the center of the bridge where the spacing was increased to form a depression in the floor for street-car tracks and ties. To each of the floorbeams, which were strengthened by welding plates on the lower side, was welded spiral reinforcing to make possible a composite deck of the concrete floor slab and the steel beams. This resulted in a very economical construction and saved considerable steel. The thickness of the concrete floor in the end spans is 7½ in. The longitudinal floorbeams are protected with a 2-in. covering of shotcrete. This concrete material in turn is further protected over the center line of the tracks of the C.R.R of N.J., where the vertical clearance is only 17 ft., by wrought-iron blast plates 4 ft. in width.

Once the east half of the new structure was completed, the traffic was routed over that portion of the bridge (Fig. 7). With this accomplished, the west trusses and remaining section of the old floor of the end spans, not incorporated in the new work, were removed and the second half of the superstructure completed in seven weeks.

An interesting detail in connection with the new structure is the type of expansion joints built into the deck.

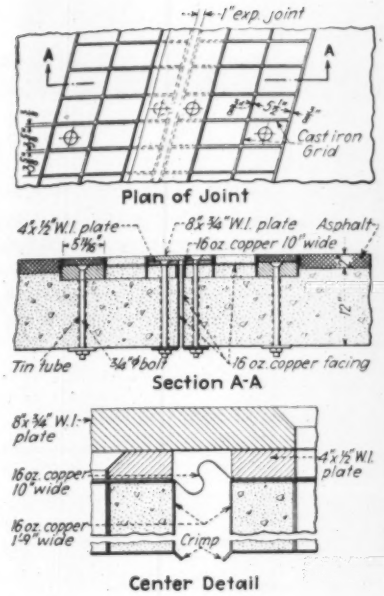


Fig. 6. The type of expansion joints used at each end of the arch span.

Fig. 7. The east half of the new bridge completed and in service and the west half under construction. The old floorbeams left in place must be extended to frame into the facia beam above the outer rib.

Four such joints are used—one at each end of the bridge and one at each end of the arch. One of the intermediate joints is illustrated by Fig. 6. The joints split a floor span along the transverse center line to form two cantilever slabs. All concrete surfaces thus cut are lined with sheet copper to prevent surface disintegration from any water that might seep through the joint. The joint is made reasonably tight by additional sheets of copper anchored underneath a set of plates spanning the joints, the plates in turn resting on a cast-iron grill bolted substantially through the floor. The bolts are accessible if replacements become necessary.

The cost of removing the old structure and building the new, exclusive of grade revisions on the northerly approach and repaving on the southerly approach, was $124,357, or about $7.80 per sq.ft. of deck. The new crossing required 115 tons of reinforcing steel, 126 tons of structural steel and 4,100 cu.yd. of concrete, of which 2,300 cu.yd. were in the abutments and the piers below the arch skew-back.

Design and construction details were planned in the office of the writer with H. K. Wilson in charge of design, and Thomas Paterson, Jr., consulting architect. DeWilde and Schwartz, Scranton, Pa., with August Schmidt, superintendent, was the general contractor. For the greater part of the work Wm. A. Schunk, retired, director of public works, was in charge for the city, but the bridge was completed under the direction of Bernard J. Harding, his successor. Cyrus M. Roberts, assistant engineer, and Iver Williams, inspector, were in direct charge. The project was scheduled to be completed in seven months, but the actual working time was considerably increased due to priorities causing delay in steel deliveries. The bridge was completed April 30.

Extinguisher for Magnesium Fires

A HIGHLY SATISFACTORY method for extinguishing magnesium fires of moderate size has recently been developed by the Central Experiment Station of the U. S. Bureau of Mines, at Pittsburgh, Pa. The extinguishing agent used is a very hard coal-tar pitch (approximately 300 deg. F. softening point). Tests indicate that hard water-gas-tar pitch and hard petroleum pitch or asphalt should also be suitable. The size of pitch recommended for this use passes a ¼-in. mesh sieve and is coarser than 35 mesh; particles finer than 35 mesh should not be used. When spread over a hot magnesium fire the pitch softens and seals the burning magnesium metal with an airtight blanket, thereby smothering the flames. The pitch is non-abrasive, readily available and cheap.

The procedure in extinguishing a magnesium fire on metal or dry concrete surfaces or dry ground is simply to spread, (do not throw), with a long-handled scoop or shovel, a layer of pitch over the burning metal and then allow the pitch to soften and seal the fire. If, after the first application, the pitch tends to burn with a short flame this can be stopped by applying a second layer of pitch over the flaming part.

On wood floors or wet ground, apply a small amount of pitch over the fire to reduce the heat and glare, then spread a layer of pitch approximately 1 in. thick on the floor alongside the fire and carefully transfer the burning mass onto the pitch layer with a shovel or hoe. The entire surface of the fire should then be covered with more pitch and any burning particles or embers from the floor scraped away at the initial location of the fire.

The Bureau of Mines does not recommend the use of coal-tar pitch for "household" protection, but thinks it desirable to restrict its use to industrial plants or places where trained firemen or fire watchers are employed.

Wire Saves Steel in Concrete Joists

***Contents in Brief**—In a new floor-system design wire has been substituted for steel bars in reinforcing precast concrete joists. Higher unit stresses in wire than in steel bars and more economical design to avoid need for special floor-and-ceiling finish, bring cost of concrete floors below that of wood construction. This procedure saves two-thirds of the reinforcing steel normally required in the floor system of a mass housing project.*

To MEET the wartime need for saving steel, a concrete floor design has been developed for mass housing projects in Los Angeles which keeps the cost actually below that for a floor system of wood with the usual plastered ceiling below. In the new design no bars are used in the entire floor system; the reinforcing in the floor itself is wire fabric and in the precast joists, cold drawn wire is used. The scheme as a whole is a later development of methods used on a Navy warehouse last fall (*ENR* Dec. 18, 1941, p. 879).

Last year's success in precasting joists, using small-diameter steel rod reinforcing, suggested the advantages of similar design when the mass housing projects were proposed. Bids on several types of construction were taken and contracts have been let for precast joist type floors on three large projects, as listed in the accompanying table, one of which is nearing completion.

In view of the large number of joists required, it was desirable to check the earlier designs carefully for possible improvements. Resultant changes have increased the shearing area of the joist section by some 35 percent as the result of thickening the web from 1½ to 2 in. (see cross-section in Fig. 3). The sides and bottoms are given a rough sand finish, resembling sawed beams, thus providing a contrast with smooth ceiling panels so that when paint is applied an artistic effect is obtained.

When bids were called on the new housing projects, figures were received on concrete, wood frame and brick walls with wood floors. As compared to the wood floors (other elements of the structure being the same) the bid on the precast joist type of floor was lower than for wood floor construction because the former eliminates the ceiling plaster on the under side and floor finish on the surface above. Other advantages are the more durable, fireproof and insect-proof construction.

The notable cost saving, as compared to the solid-slab floor type, results from a combination of several savings which range, as a total, from 8 to 10 c. per sq.ft. of floor area. By using joists instead of flat slabs, the floor thickness was reduced from 5 to 3 in. (for joists 3 to 4 ft. apart), which made it possible to give sufficient slab reinforcement with standard wire mesh. The cold drawn wire (No. 6 to No. 0) in the joists permit use of a working stress of 30,000 lb. per sq.in. as compared to the 20,000 lb. allowable in steel bars.

This combination of savings produces a design so economical that the total steel requirements in the floor system are reduced by two-thirds. The standard 5-in. concrete floor slab with 12 to 14-ft. spans, reinforced by ½ to ⅝-in. rods, calls for about 3 lb. of steel reinforcing per sq.ft. With the precast joists and the use of only wire reinforcing, steel requirements are reduced to less than 1 lb. per sq.ft. of floor surface.

Facilities at the plant where the joists are made have been greatly increased but the same methods are used except in the shop where the reinforcing assemblies are put together. Here the reinforcing wire,

HOUSING PROJECTS NOW UNDER CONSTRUCTION IN LOS ANGELES USING PRECAST CONCRETE JOISTS

Project Name	Number of family units	Precast Joists	Total joisted floor area (square feet)	Type of Construction
Pueblo Del Rio	400	6,000	288,000	Brick walls Concrete floors Concrete roofs
Wm. Mead Homes	450	7,200	335,000#	
Aliso Village	802##	7,300	414,000*	Twelve large 3-story buildings**

\# Includes 2nd and 3rd floors and roof
* Includes three floor levels
** Reinforced brick walls, concrete floors, wood roof
\#\# 21 two-story wood and stucco buildings 12 three-story masonry and concrete buildings (all 33 have precast joist construction in first floor)

Fig. 1. Freshly cast concrete floor joists still on the steel pallets used in casting. Projecting wire and rough top surface are for bonding into floor slab.

which comes in coils, is run through straightening rolls to which is attached an automatic cutoff. When a predetermined length of wire has been straightened, it is automatically cut off and allowed to drop into a stock pile. The attendant starts each coil, sees that the machine operates properly, bundles the wires in the stock pile and transfers them as "bundle wires" to storage on a nearby assembly rack or jig where the several reinforcing wire shapes are put together into "assemblies."

Wire parts assembled on the jig are stirrups, bundle wires and a single longitudinal wire used for stiffening. Stirrup wires are shaped on punch presses and fastened by a spot-welding machine. The stirrup wires are first bent into rectangular shapes whose lower ends may be straight or curved and then two additional wires are attached. A curved carrier (for the bundle bars) is formed by putting a No. 6 wire through a punch press and this carrier and a piece of straight wire that serves as a spacer are spot-welded to the stirrup in a single operation.

The spacer (which is horizontal when in the form) keeps the stirrup centered while the concrete is being poured. The curved carriers are supports for the bundle bars up to the time the hardening concrete holds them permanently in place. Curved lower ends of the stirrups provide anchorage in the concrete. Each stirrup wire is split near the top, by a punch press operation, to provide an opening through which a single longitudinal stiffening wire can be passed to hold the assembly in shape during handling and placing in the form.

The jig on which the reinforcing assemblies are put together has pegs on which the stirrup wires are hung while the various component parts are being arranged and fastened. (The pegs can be changed for different joist designs.) When the bundle bars are placed in their supports and have been secured with tie wires, the longitudinal wire at the top is thrust through the openings formed by splitting the stirrups and this wire is also fastened to give the assembly rigidity. When all parts are in place the assembly is lifted off the jig and stock-piled near the door of the shop, handy for loading the cart that makes deliveries from shop to compaction table.

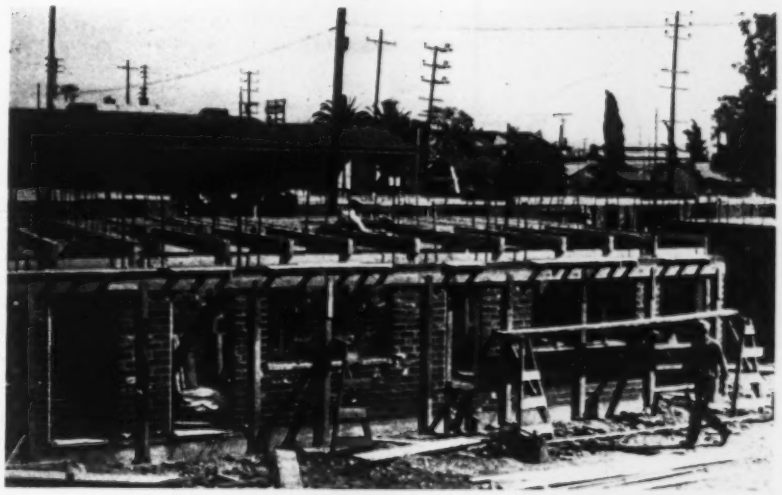


Fig. 2. Precast joists for the second floor have been set in place. This is typical of the brick wall construction on the Del Rio project.

After coming from the compaction machine previously described (*ENR*, Dec. 18, 1941, p. 879), precast joists are stock-piled by overhead cranes until ready to be transported to the job. Shipment is by a semi-trailer built with a bed 30 ft. long so that it can carry two piles of 14-ft. joists. Arriving at the job, joists are delivered from this trailer into place in the building by a truck crane that picks up the joists, usually seven at a time, by a strong back with chains to hooks passed through the projecting loops of stirrups.

After joists are set in place on 3-ft. centers, 2x3-in. wood purlins with metal-shod tips are rested, 30 in. apart, on the ½-in. ledges in the sides of the joists provided for this purpose. Then 1x6 boards, three to the panel, are laid on the purlins, parallel to the joists, as a base for the plywood panels that serve as bottom forms for the concrete floor (Fig. 5).

Each plywood panel is about 10 in. narrower than the space between the joists thus allowing a 5-in. margin on either side where the beveled edge of the plywood increases the thickness of the concrete floor slab along both sides of the joist. This thickened slab is made with great economy of form lumber by tacking the plywood panels to the outer two 1x6's that rest on the purlins (center 1x6 not nailed).

Joists weigh 23 lb. per foot

Shores are occasionally set at midspan beneath the precast joists when construction operations impose an exceptional load, as when concrete buckets are landed on the second floor. The dead weight of the standard 3x8-in. joist in the 14-ft. length is 23 lb. per foot or 322 lb. per joist. Thus far precast joists of two types have been used, shown in the drawing as "J" and "K." Wire sizes required range from No. 0 to No. 6; the number of bundle wires (longitudinal reinforcing) that hang in the

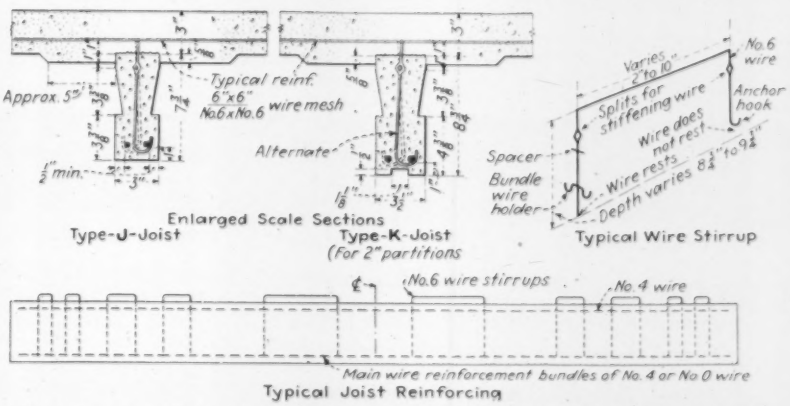
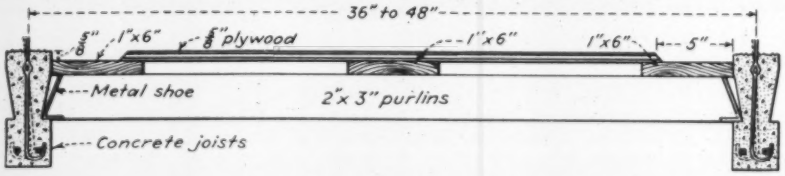


Fig. 3. Cross-sections and longitudinal elevation of the precast joists with details of stirrup and partition joint.

Fig. 4. When the second floor concrete is poured, floor slab and joists are bonded together. Note cast-in-place utility openings and the grooved bottom edge of joist over partition.

Fig. 5. Section through floor forms showing arrangement of support.



carriers near the bottom of the joists, varies from 6 to 10.

With panel forms of this sort, it is possible to cast floor slabs that will contain ready-made utility openings, exactly spaced. This is done by gluing and bolting to the plywood forms blocks of white pine carefully located in exact position and slightly tapered to facilitate removal after the concrete has set. The wire mesh spread on the forms for reinforcing the floor is cut and fitted around these projections and as the same form is used repeatedly (ordinarily about ten times) exactly duplicated spacings for utility openings are insured.

Stairs are precast

In addition to the precast joists, door and window sills, stairs and other units are similarly precast. Particular attention has been given to stairways, of which some 950 flights are required on the three projects here mentioned. On such details as stairways, further improvements are made from time to time. For example, on the Del Rio project, it was noted that the plastering of walls beside stairways would have been simplified if each stair stringer had been cast with a 1-in. baseboard as an integral part of it. Such a baseboard would provide a desirable ground for the plaster and would avoid making the difficult plaster joints around treads and risers where even well-made joints are likely to crack. Accordingly, in the stairways to be cast for the Mead and Aliso projects, stair stringers will carry precast baseboards.

Floor joists that are to have partitions beneath them are recessed along the underside so that metal lath for the partition can extend into the joist and better plaster joints can be made. This design provides an effective seal against vapors, light or insects that could pass through cracks likely to occur if the partition were put in with a butt joint and it also provides lateral anchorage against seismic forces.

The Del Rio project, now nearing completion, has been built according to plans laid out by Southeast Housing Architects, Associated, Los Angeles. Revision of floor and roof system designs to adapt them to the precast concrete system was suggested by the Wailes-Bageman Co. and the revised engineering plans were prepared by H. C. Whittlesey, structural engineer. Prefabrication and installation of the all-precast units, as well as placement of concrete forms and wire mesh, is under contract to the Wailes-Bageman Co. which also holds contracts for supplying the prefabricated concrete for the other two projects mentioned. R. E. Campbell is the general contractor on the Del Rio project.

Continuous Centrifuge For Sludge Dewatering

SUCCESSFUL EXPERIMENTATION with a centrifuge for dewatering sludge from filters is reported in the official bulletin of the Illinois State Department of Public Health by H. D. Clark, chemist of the Kankakee (Ill.) Water Co. Mr. Clark states that the machine used is of the horizontal solid bowl type, with conical bowl 18x28-in. Its operation differs from that of machines of the batch type in that there is no building up of solids in the bowl, as they are extracted by a conveyor at the base of the machine, while the clarified water is discharged at the other end. A differential gear gives the conveyor a speed of 25 rpm. for a bowl speed of 2,000 rpm.

If this equipment is adopted, a building will be erected, having the centrifuge at the top, with one or two large hopper-shaped bins under it to receive the sludge, and with space below these for motor trucks that will remove the sludge. The bins will have sufficient capacity for three or four days' storage when the company's truck is not available. In the experimental installation, a truck is placed below the sludge discharge, and after the machine is started it runs until the truck is full. The effluent is run to the sewer.

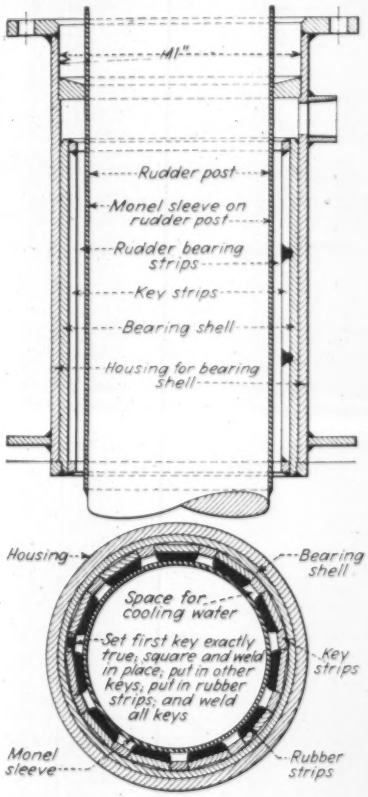
The average capacity has been one and one-half tons of sludge per hour, having a moisture content of 34 percent in the cake. Best results have been attained by applying carbon dioxide gas to the raw sludge before running it through the machine. In a test with a feed of 15 gpm., the solids were 27.2 percent in the feed, 67.4 in the cake and 2.6 in the effluent of the sewage.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Rubber Bearing for Rudder Post

A rubber bearing that greatly reduces the cost of the usual cast-bronze bearing for rudder posts and saves war material has been devised by Harry C. Elliot, company engineer for the Mississippi Barge Line Co., Cincinnati, Ohio. As shown by the accompanying sketch, the bearing consists of a steel pipe shell lined inside with rubber strips held in place by metal keys welded to the shell through countersunk holes in the shell. The rubber is prevented from burning by placing copper strips on both sides of the key and by welding at short intervals.


Rudder post
Monel sleeve on rudder post
Rudder bearing strips
Key strips
Bearing shell
Housing for bearing shell
Housing
Bearing shell
Space for cooling water
Set first key exactly true; square and weld in place; put in other keys; put in rubber strips; and weld all keys
Key strips
Monel sleeve
Rubber strips

Water-cooled rubber replaces cast-bronze bearing.

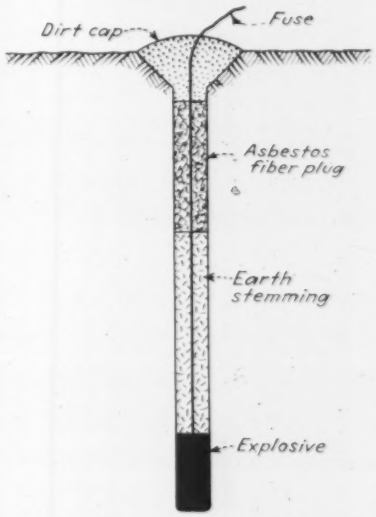
These bearing shells do not need to be a hard-press fit in the housing in the hull. The bearings are simply slipped into place and a bead of weld metal is run around the lower flange to hold the bearing securely in place. Water is fed to these vertical bearings through a pipe connected to another point in the tunnel and the force of water from the propellers drives a stream of water through the bearings.

For the bearing shown in the drawing, a $\frac{3}{16}$-in. thick monel sleeve was welded on the steel rudder post, using monel welding rod and turning it smooth for the rust-proof smooth surface required for rubber bearings. The shell for this particular bearing was made from 10-in. extra-heavy pipe bored to $10\frac{1}{8}$ in. I.D., turned to 10.735 in. O. D., with an $11\frac{3}{4}$-in. dia. flange at the bottom. Then the eleven pieces of keystock were welded in place with a ring at the top and bottom welded into place to hold the rubber strips endwise. The cost of this bearing is $22.52 as compared with $87.30 for a cast-bronze bearing. — ROBERT WAGNER, *Hobart Brothers, Troy, Ohio.*

Fiber Plug Curbs Blast Noise

Where blasting must be done in the vicinity of hospitals, schools and similar institutions, very effective results in noise control are being secured on Ohio River valley defense projects by the use of asbestos fiber plugs placed in the tops of the blast holes.

The material used is short-fiber asbestos in loose form and dry. The holes are drilled to the desired depth and loaded in the usual manner: the required amount of earth stemming is placed over the charge, and the hole is then filled to the top



Very effective results secured in noise reduction by plugging blast holes.

A Simple Splice for Long Wood Handles

At first it was difficult to make splices in the long wood handles used with floats that finish concrete surfaces on the deck of the Pit River Bridge. These handles were occasionally broken, requiring to be repaired by some form of splice, and sometimes additional floats had to be made up hurriedly when pieces of the necessary lengths were not conveniently at hand.

A highly satisfactory expedient was the use of a 10-in. length of ordinary iron pipe of the proper diameter in which holes were bored to receive small bolts, as shown in the accompanying illustration.

A bolted pipe sleeve makes a strong splice in a long wooden handle.

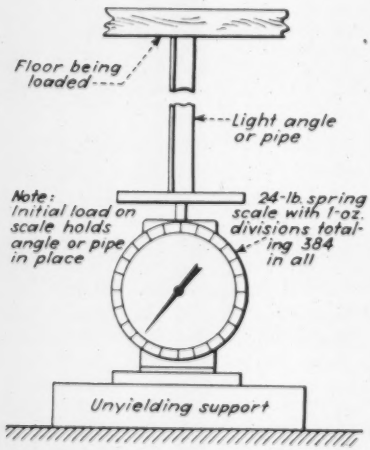
with asbestos fiber (pressed down tightly) and a small amount of earth is placed over the top to hold the fiberous mass snugly in place.

The rule is to allow 3 in. of fiber to every 12 in. of hole-face; thus, a drillhole 4 ft. deep requires a fiber plug 12 in. long. Results registered on sound-recording equipment show that blast-noise from charges in holes thus treated is 15 to 28 percent less than in untreated holes with the same charges. There is also a marked lessening of surface vibration due to use of the plug.

The fiber plug is successful under various weather conditions so long as it is kept dry. Detonations may be made by either electric blasting-cap or fuse.—F. R. Cozzens, *Stockport, Ohio.*

Spring Scale Measures Deflections of Loaded Floors

A spring scale, set up as shown by the accompanying sketch, will measure deflection of loaded floors where proper testing equipment is not available. A scale will cost about a dollar and it generally reads to 24 lb., with 1-oz. divisions. As set up by the writer, the scale is first calibrated by depressing the pan to the full 24-lb. limit and measuring the distance of movement. The fraction of an inch


Floor being loaded
Light angle or pipe
Note: Initial load on scale holds angle or pipe in place
24-lb. spring scale with 1-oz. divisions totaling 384 in all
Unyielding support

Spring-scale set up for measuring floor deflections.

the pan depresses per ounce movement of the needle is then calculated. On some scales used by the writer the pan has depressed ½ in. for the full 384 oz., so that one-ounce movement of the pointer indicated 1/768-in. depression.—Frank M. Weakley, *Dallas, Tex.*

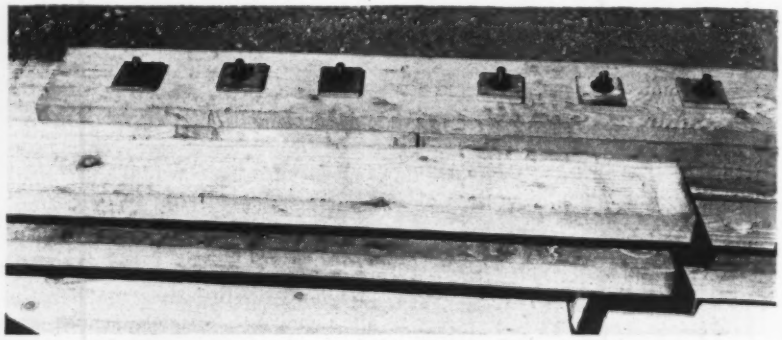
Notes From War Jobs

METHODS USED TO SPEED CONSTRUCTION AND WIN THE WAR

Plywood Washers Save Metal

Fabrication of timber trusses usually requires a great number of cut washers to make up for the variations in total thickness of the several members connected by each bolt, due to the variations in individual member thickness. One contractor on a Midwest ordnance plant where hundreds of wood trusses are being used found that washers made from the scrap plywood from the forms eliminated many cut washers and thus conserved metal.

The plywood $\frac{9}{16}$ in. thick, is cut into 4-in. squares, and bored $\frac{13}{16}$ in. to take a ¾-in. bolt. Experience soon showed that the extra time required to tack the washers in place square with the outside truss member paid dividends in appearance. One cut washer is placed under the nut. Smaller washers, 3x3 in., were tried, but some of this size split when the bolts were tightened. None of the 4x4-in. size have split or cracked. In fabricating the last 200 of a group of 50-ft. trusses, the contractor estimated the use of plywood washers saved 180,000 metal washers and a corresponding amount of iron.



Plywood washers save metal in fabricating timber trusses.

No Tools, No Pay—On one of the big Quartermaster depot jobs where the total number of employees during the peak period reached 6,800, a system of keeping track of tools was established by the engineer officer in charge, under which each workman received a numbered brass check as he checked in at the timekeeper's office. If he needed a tool for his work, he drew it from the area tool warehouse where he surrendered his check as a receipt for the tool. On completion of the day's work, or of the particular use of the tool, the tool had to be returned to the warehouse to release the brass check. Unless the check was turned in at the timekeeper's office on leaving, the man was not paid for the day's work.

Paging Men in the Field—Grading operations at the start of construction on a large Quartermaster base for the Army were so widespread that it was almost impossible to locate one of the field men for a rush call after he had left his office. Due to the relatively short time in which the operations would be spread over the whole area, it was not considered economical to attempt to set up any outlying telephone call stations. Instead, a public-address system was set up on a 100-ft. wooden tower near the center of one of the long sides of the job. By use of the loudspeaker to broadcast the statement that any particular man was wanted at his office or at the motor pool, it was possible to reach that man immediately. The system worked effectively until buildings began to go up, after which calls could not be heard in the building area because of local noises and due to the shielding effect of walls. By that time, however, major operations were much more concentrated and the key men could be located much more quickly.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Ship Construction

PRACTICAL CONSTRUCTION OF WARSHIPS—By R. N. Newton. 318 pp. Longmans, Green & Co., London, New York and Toronto. Price $6.

This book relates to British practice in the construction of ships, being written by a member of the Royal Corps of Naval Constructors to bring together in convenient form information contained in his lectures at the Royal Naval Engineering College and before apprentices at the Royal Naval Dockyard, Davenport. Reasons why particular types of construction have been adopted are given, as well as the methods of construction themselves. The arrangement of chapters concerned with construction is in the order of erection as far as possible. The book is copiously illustrated.

SHIPBUILDING TERMS—Compiled by Trade and Industrial Education Service, Alabama State Department of Education in cooperation with other agencies. American Technical Society, Chicago. 50c.

The many construction men who are finding themselves diverted from their normal occupations into shipbuilding by the great expansion of the latter industry will find this little booklet helpful in learning the language of their new field.

Civil Protection

HANDBOOK OF CIVILIAN PROTECTION—Prepared by the Civilian Defense Council of the College of the City of New York. 184 pp. Whittlesey House, New York. $1.25.

WHAT THE CIVILIAN SHOULD KNOW ABOUT CIVILIAN DEFENSE—By Walter D. Binger and Hilton H. Railey. 183 pp. W. W. Norton & Co., New York. $2.50.

Two books just issued are designed to meet current needs for nontechnical inexpensive books containing up-to-date information on civil protection in wartime.

The first, "Handbook of Civilian Protection," is truly a handbook of pocket size presenting in concise and easily available form information on air-warden service, fire fighting, incendiary bombs and high explosives, poison gas, first aid, conservation and salvage, and nutrition in the war emergency. It explains the organization and duties of the civilian defense corps, methods of combating fire bombs, and precautions to be taken against poison gases. A valuable feature is the selected critical bibliography of subjects covered in condensed form in the handbook.

Binger's and Railey's book is written as a continuous text for popular reading. It is packed with sanity and commonsense, the background for which is the first-hand knowledge of conditions in England gained by Walter D. Binger on his trip to that country last summer as chairman of the National Technological Civil Protection Committee. That knowledge is used to advantage to lay before citizens of this country the lessons learned by bitter experience in England. Especially valuable is the emphasis put on the need for an engineering approach to the problems of protecting civilians against air attack and those of minimizing the effect of bombing in structures and services. A warning is sounded against spending so much on civil protection as to interfere with the war effort.

When the War Ends

THE ROAD WE ARE TRAVELING—By Stuart Chase. 106 pp. The Twentieth Century Fund, New York. First of a series of six books. Price $1 each; $5 for series of six.

Economic research can make dull reading but not when Stuart Chase wields the pen—controversial, perhaps, but never dull. This first of a series of six books combines a swift review of the trends in American life from 1914 to 1942 with an exploration into the problems that will face this country when peace comes. It provides the general plan of the main issues from which succeeding books in the series will develop in detail the questions raised.

Of direct economic interest to civil engineers and contractors are Mr. Chase's views of the effects of the lagging population curve, the closing of the frontier in the United States, the excess capacity of many industries and the decline of investment opportunities.

Mr. Chase sees the era of extensive investment by private capital giving way to an era of intensive development with public money in which interest will center on making better cities rather than bigger ones.

The research facilities of The Twentieth Century Fund have been available to Mr. Chase. His conclusions are his own. His views are challenging, but not necessarily final or incontrovertible.

Travel in the Orient

AN ENGINEER IN THE ORIENT—By R. W. Lawton. 201 pp. Walton & Wright, 672 Lafayette Park Place, Los Angeles. $2.

Welcome relief from the depressing war news now coming to us daily from the Orient in press and over the radio is found in this account of the travels and observations of an engineer whose early trips through the Orient were before the days of World War I. Mr. Lawton's travels began with an engagement to go to Trieste to take charge of construction operations for an American engineering firm. From there he went to a remote part of India to take charge of the first modern filtration plant built in that country. In later years he returned to India to study and practice as a consulting engineer. Mr. Lawton's book is full of interesting observations as to places and customs, which he views with an engineer's eye. This gives his comment special interest to engineers.

Seaway Propaganda

THE ST. LAWRENCE SURVEY—In seven parts: I, History; II, Shipping Services; III, Potential Traffic; IV, Effect of the Seaway on Existing Harbors; V, Future Transportation requirements; VI, Economic Effects of the Power Project; VIII, Summary Report. 343 pp. Prepared by the St. Lawrence Survey, U. S. Department of Commerce. Obtainable from the Superintendent of Documents, Washington, D. C. Price: Part I, 10c.; II, 25c.; III, 40c.; IV, 15c.; V, 15c. Prices for Parts VI and VII not given.

After more than two years of work the Department of Commerce has completed and published an elaborate study of the St. Lawrence seaway and navigation project. The staff that prepared the report labored under the disadvantage of knowing that the President, who had authorized their study, was leaving no stone unturned in his effort to get the St. Lawrence power project started. As

a consequence, it was to be expected that wherever there was doubt as to how facts should be interpreted, they would be interpreted in favor of the seaway and power project, much as the Brookings Institution study of the project (*ENR* Sept. 19, 1929, p. 468) appeared to put an unfavorable interpretation on doubtful factors. But this new study of the controversial subject is filled with evidence that the survey staff went far beyond even what might have been expected of them in the peculiar circumstances under which they labored. Thus in Part VII, in an effort to refute the claim of opponents of the project that, if the power is needed for war purposes, labor could be saved by building steam stations instead of hydro stations, the survey staff sets the labor requirements for the St. Lawrence hydro-electric project over against the labor requirements for equivalent steam stations *plus the labor requirements to build "railroad equipment that would be needed to carry 10 million tons of traffic during the open season of navigation."* On this absurd premise the staff finds that "the St. Lawrence would require less labor, and therefore would be more economical and desirable in this period of great national defense effort, than alternative services."

This is an extreme example, but it serves to show how confidence in what ought to have been a valuable record of up-to-date information concerning the St. Lawrence project is largely destroyed by the lack of judicial approach to the subject on the part of the St. Lawrence Survey staff.

Transportation in War

TRANSPORTATION AND NATIONAL DEFENSE—By Joseph L. White. 91 pp. University of Pennsylvania Press, Philadelphia, Pa. $1.25.

This small book is made up of four lectures delivered at Lafayette College in 1941 by the author, who is transportation consultant to the National Resources Planning Board. Subjects covered are: Present condition of the railroads with respect to operating capacity and government control as compared to conditions during World War I; developments in highway transportation since World War I, with comment as to the place of highways in meeting transportation needs of today; the place of waterways, pipelines and airways in the transportation system; and the pros and cons of the St. Lawrence seaway project.

Modern Lighting

FLUORESCENT LIGHTING MANUAL — By Charles L. Amick. 312 pp. McGraw Hill Book Co., New York and London. $3.

Fundamentals of fluorescent lighting are set forth in this book for the guidance of all those who plan to use this newest form of illumination. The author states that the characteristics of fluorescent lamps are so varied as to call for knowledge of those characteristics if the user is to get the most out of installations of fluorescent lights. The book gives this basic information in as simple language as possible. It also gives some of the recent knowledge on general principles of adequate lighting.

Miscellaneous Notes on Booklets and Reprints

A BIBLIOGRAPHY of books, periodicals and society publications on waves and wave action from 1687 through April, 1942, has been compiled by Claude C. Lee, 1315 First North St., Vicksburg, Miss., and is being published in mimeographed form by the author. Price $5.

SPECIFICATIONS FOR ASPHALT PAVING MIXTURES to be stock-piled for making quick repairs have been issued by The Asphalt Institute, 801 Second Ave., New York. They were prepared for the Corps of Engineers for use in planning for resurfacing areas destroyed by bombing. Copies free on application.

A FIELD INSPECTOR'S CHECK LIST for building construction has just been issued by the National Bureau of Standards. It is intended to be used by field inspectors as a guide and daily reminder, the subject being covered by stages of work rather than by trades. The pamphlet is known as "Building Materials and Structures Reports, BMS 81." Copies can be obtained from the Superintendent of Documents, Washington, D. C. Price 20c.

WAR PRODUCTION TRANSPORT is the subject of an article reprinted from *Traffic Engineering*, April, 1942. Copies may be obtained from the Institute of Traffic Engineers, 60 John St., New York City.

THE SECOND MILE, a revision of an address by William E. Wickenden, president of Case School of Applied Science, before the Engineering Institute of Canada, has been reprinted from *Electrical Engineering* by the Engineers' Council for Professional Development, 33 West 39th St., New York. The paper is a notable discussion of the things done in the "mile of voluntary effort" that lies beyond the "mile of compulsion," the doing of which makes engineering a profession rather than a vocation.

ENGINEERING ESSENTIALS FOR WELDERS, a paper by H. Malcolm Priest, engineer of the railroad research bureau of the U. S. Steel Corporation Subsidiaries, has been published by the American Welding Society, 33 West 39th St., New York, in pamphlet form. Price, 25c.

New Engineering Books

MUNICIPAL YEAR BOOK—1942. 685 pp. The International City Managers' Association, Chicago. Price $8.50.

CONCRETE PIPE LINES—272 pp. American Concrete Pipe Association, 33 West Grand Ave., Chicago, Ill. Limited distribution by the members of this association.

U. S. ARMY—Annual report of the Chief of Engineers. Part I, Volumes 1 and 2. Superintendent of Documents, Washington, D. C.

PRACTICAL CONSTRUCTION OF WARSHIPS—By R. N. Newton. 302 pp. Longmans, Green and Co. London, Toronto and New York. Price $6.

HANDBOOK OF WELDED STEEL PLATE CONSTRUCTION—288 pp. Buffalo Tank Corp., Buffalo, N. Y. and Dunellun, N. J. Limited distribution.

ENGINEERING DRAWING AND MECHANISM—By Harold J. Brodie. 271 pp. Harper & Brothers, New York and London. Price $2.25.

HANDBOOK OF SCIENTIFIC AND TECHNICAL SOCIETIES AND INSTITUTIONS OF THE UNITED STATES AND CANADA — Fourth Edition. National Research Council, 2101 Constitution Ave., Washington, D. C. Price $4.

WHAT THE CITIZEN SHOULD KNOW ABOUT CIVILIAN DEFENSE—By Walter D. Binger & Hilton H. Railey. W. W. Norton & Co., New York. 171 pp. Price $2.50.

(*Continued on p.* 110)

TO ASSURE VICTORY
BUY UNITED STATES WAR SAVINGS BONDS & STAMPS

TIMKEN ROCK BITS

increase his production

thereby increasing the fighting effectiveness of the man behind the gun

The astonishing increase in efficiency of Timken Removable Rock Bits as compared with bits forged as any integral part of drill steel in mines, quarries and on all kinds of construction projects is of tremendous importance in America's total war.

Here are but a few reasons why we have no hesitation in making the above statement. 1. Although ground conditions affecting drilling speed vary tremendously, Timken Bits increase drilling speed 20% on the average with a corresponding increase in production. This is a conservative estimate. 2. Timken Bits effect a 90% reduction in drill steel handling and a like reduction of manpower required for this work. Where transportation facilities (such as hoists in deep mines) are at a premium the use of Timken Bits releases such equipment for productive work. 3. Timken Bits have reduced by 30% the labor force required for reconditioning.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN

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ROCK BITS

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

WATER TUNNELS, CHICAGO

OWNER: City of Chicago; Oscar E. Hewitt, Commissioner of Public Works. W. W. DeBerard, City Engineer.

PROJECT: Tunnel connections from new South District Filtration Plant to Southwest Land Tunnel System. Includes driving and lining of 16-ft. circular tunnel in E. 74th St., 13-ft. circular tunnel in Oglesby Ave., branches, stubs, riser shafts, gate and valve installations.

CONDITIONS: Project is extension of existing tunnels. City owns a 14-ft. construction shaft, equipped with electric elevator and 10-ton derrick, certain buildings, power lines, centrifugal pumps installed to keep tunnels dry, and 100 ft. of 16-ft. steel forms, all available to contractor without charge except for operation and maintenance. Project has A-2 priority rating. The 10-ft. gate shaft must be sunk by caisson method. Muck is to be disposed of in Lake Michigan near the filter plant. Minimum wage rates specified include: Hoisting, mixer, compressor and pump engineers, and ironworkers, $1.70, all overtime at double rate; miners, $1.425; caisson diggers, $1.35; muckers, $1.275; concrete workers, $1.175; common labor, $1.025; all on overtime basis of 1½ rates for first 2½ hr., then double time.

BIDS: Five bids were received on April 2, 1942:

LIST OF BIDDERS:

1. Wenzel & Henoch, Milwaukee, Wis $737,294
2. John C. Tully & Co., Chicago 785,190
3. Paschen Contractors, Inc., Chicago 820,273
4. Kenny Const. Co., Chicago 836,018
5. M. Pontarelli & Sons, Chicago 1,074,546

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Tunnel, 16-ft., tangent	3,050 l. f.	$146.00	$156.00	$167.30
2. Tunnel, 16-ft. curve	110 l. f.	195.00	224.00	208.07
3. Tunnel, 13-ft. tangent	950 l. f.	118.00	139.00	137.81
4. Tunnel, 13-ft., curve	118 l. f.	188.00	195.00	168.01
5. Rise shaft, 10-ft	L. S.	2,600.00	2,800.00	2,735.25
6. Vent shaft, 5-ft	L. S.	8,000.00	8,500.00	5,755.75
7. Tunnel conn., Yates Ave	L. S.	15,000.00	13,000.00	14,924.00
8. Tunnel conn., Oglesby Ave	L. S.	7,160.00	10,700.00	8,844.50
9. Tunnel stub, 13-ft	L. S.	29,500.00	27,200.00	29,172.00
10. Gate shaft, 10-ft	L. S.	30,700.00	22,100.00	28,294.00
11. Install 72-in. gate valve	L. S.	16,000.00	20,000.00	20,000.00
12. Timbering in rock	50 Mf.b.m.	120.00	100.00	90.00
13. Special grout	1,000 bbl.	8.00	7.70	8.00
14. Reinf. steel	10,000 lb.	.08	.05	.065
15. Rock excav	500 c. y.	10.00	5.00	10.00
15. Add'l concrete	500 c. y.	12.00	15.00	14.00
17. Tunnel drainage	30 days	50.00	73.00	50.00

HIGHWAY, WEST VIRGINIA

OWNER: West Virginia State Road Comn., Charleston, W. Va.; C. H. Boggs, district engineer.

PROJECT: Improving of 3.086 miles of highway from 3rd Street, St. Albans, W. Va., to Highlawn Underpass Road, all in Kanawha County. Includes grading, draining, concrete pavement, and construction of bridge. Highway to be 44-ft. wide, 4-lane, 8-in. uniform plain concrete pavement.

CONDITIONS: Contractor to furnish all materials and complete work in 225 working days. Rail, highway, and water transportation facilities available, but use of water transportation facilities is most likely. Wage rates are: skilled labor, $1.35 per hr.; semi-skilled, $1.20; and common, 60c.

BIDS: Five bids were received March 31, 1942, ranging from the contract low of $495,509 to $597,205.

LIST OF BIDDERS:

1. Keeley Constr. Co., Clarksburg, W. Va. (contract) $495,509
2. Hatfield Constr. Co., Huntington, W. Va 554,188
3. Pinnell & Pfost, Ripley, W. Va. 591,500
4. Price Constr. Co., Huntington, W. Va 597,116
5. McHugh Bros., Springfield, Ohio, and Veceillio & Grogan, Beckley, W. Va 597,205

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clearing right-of-way	16,299 l. f.	$0.10	$0.04	$0.15
2. Unclassified excavation	82,500 c. y.	.50	.60	.70
3. Borrow	56,700 c. y.	.35	.50	.38
4. Rock borrow	95,700 c. y.	1.15	1.40	1.70
5. Overhaul	2,300,000 st. yd.	.0075	.005	.0065
6. Structure excavation	2,170 c. y.	2.00	3.00	3.50
7. Concrete pavement, 8-in. uniform	86,890 s. y.	2.50	2.72	2.70
8. ¾-in. longitudinal joint	6,730 l. f.	.15	.12	.12
9. ¾-in. transverse expan. joint	6,400 l. f.	.20	.16	.16
10. 24-in. plain concrete pipe	520 l. f.	2.75	3.00	2.40
11. 18-in. rein. conc. pipe	2,360 l. f.	2.50	2.50	2.35
12. 24-in. rein. conc. pipe	160 l. f.	3.50	4.00	3.50
13. 36-in. rein. conc. pipe	205 l. f.	6.00	8.00	7.00
14. Class A concrete	527 c. y.	26.00	28.00	27.00
15. Class B concrete	317 c. y.	24.00	27.00	22.50
16. Riprap	100 c. y.	6.00	4.00	5.00
17. Reinforcing steel	63,220 lb.	.07	.08	.065
18. Dowel bars	36,470 lb.	.07	.08	.08
19. Sidewalk inlets	14 ea.	100.00	80.00	80.00
20. Manhole frames and covers	4 ea.	40.00	30.00	40.00
21. 6-in. concrete curb	29,340 l. f.	1.00	1.00	1.40
22. 6-in. integral curb	2,600 l. f.	.70	.70	.80
23. Concrete sidewalks	580 s. f.	.35	.40	.50
24. Creosoted timber piling	6,300 l. f.	1.50	1.60	1.10
25. Waterproofing	755 s. y.	1.25	1.30	1.80
26. Manholes, except castings	4 ea.	75.00	100.00	90.00

BRIDGE, WEST VIRGINIA

OWNER: West Virginia State Road Comn., Charleston, W. Va.

PROJECT: Construction of South Charleston Overhead Bridge (No. 1588), at South Charleston, Kanawha County, W. Va. Involves erection of 18 continuous concrete deck girder spans and 9 concrete slab spans on concrete substructure. Roadway width 24-ft. on each of two lanes. Clearance over tracks 22-ft. Median strip in roadway 3-ft. wide. Approximately 1,000 ft. long.

CONDITIONS: Contractor to furnish all materials and complete work in 150 working days. Rail, highway and water transportation facilities available, but it is expected that the highway facilities will be most used. Wage rates are: skilled labor, $1.35 per hr.; semi-skilled, $1.20; and common, 60c.

BIDS: Two bids were opened April 28, 1942, the contract low of $398,539, and $418,592.

LIST OF BIDDERS:

1. Pocahontas Constr. Co., Lewisburg, W. Va., and Monty Bros., St. Albans, W. Va. (contract) $398,539
2. Dodd & Archer, Spencer, W. Va., and J. M. Francesa & Co., Fayetteville, W. Va 418,592

Item	Quan.	Unit Prices (1)	(2)
1. Dry excavation	4,670 c. y.	$2.50	$2.00
2. Class A conc., superstructure	3,076 c. y.	26.00	32.00
3. Class A conc., substructure	897 c. y.	26.00	30.00
4. Class B concrete	3,559 c. y.	23.00	25.00
5. Concrete railing	2,900 l. f.	5.00	5.00
6. Reinforcing bars	977,975 lb.	.06	.06
7. Electric welded wire fabric	175 lb.	.10	.20
8. Bituminous waterproofing	1,275 s. y.	1.50	1.25
9. Creosoted timber piles	47,840 l. f.	1.90	1.65
10. Structural steel	L.S.	10,860.00	11,000.00
11. Cast steel shoes	L.S.	9,000.00	11,000.00
12. Roadway drainage system	L.S.	2,500.00	4,000.00
13. Structure excavation	610 c. y.	2.00	2.50
14. 12-in. rein. conc. pipe	430 l. f.	1.50	2.00
15. Relaid pipe	332 l. f.	1.00	2.00
16. Class B concrete	20 c. y.	25.00	25.00
17. Manhole frame and cover	1 ea.	100.00	100.00
18. Manholes, except castings	2 ea.	90.00	100.00
19. Reset manhole, frame and cover	1 ea.	10.00	25.00
20. Slag macadam base course	720 c. y.	7.00	6.00
21. Slag prime	30 ton	5.00	12.00
22. Tar prime	1,620 gal.	.25	.25
23. Asph. conc. pavement, wearing course	160 ton	15.00	12.00
24. Subgrade, fine grade and shoulders	3,625 s. y.	.10	.50
25. Borrow excavation	2,000 c. y.	1.00	1.25

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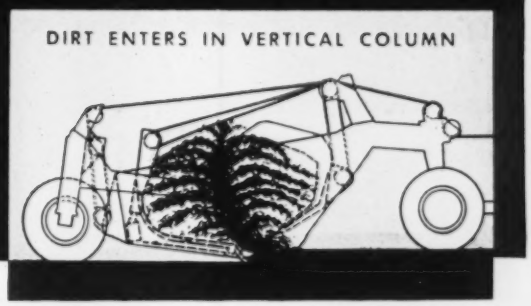
FOR FAST LOADING

Bucyrus-Erie

4 WHEEL SCRAPERS



This diagram of the "boiling" action shows how the dirt flows evenly into both apron and bowl by the shortest possible route.

Bucyrus-Erie Scrapers load fast and in short distances because the cutting edge is double-curved (curved both vertically and horizontally) to "boil" the dirt up easily into both apron and bowl.

The **vertical curve** "curves" the dirt upward, just as the moldboard on a plow does. The dirt, entering in a vertical column, rises up through the load until it rolls out on top. Thus, you get maximum effectiveness from tractor power, because the last dirt entering the scraper doesn't have to push and pack the whole load in order to get in.

The **horizontal curve,** like the round point on a hand shovel, makes penetration easy and rolls the dirt inward toward the center of the bowl. This "rolling inward" action provides easy loading by reducing sidewall friction.

This two-way rolling action breaks up the dirt as it enters the bowl so that the scraper fills evenly with minimum voids, to give heaping payloads every time. The broken up dirt also rolls out easily for fast, free-flowing ejection. — BUCYRUS-ERIE COMPANY, South Milwaukee, Wisconsin.

BUCYRUS ERIE TRACTOR EQUIPMENT

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STREET PAVING, CHICAGO

OWNER: City of Chicago, Department of Streets & Electricity.

PROJECT: Concrete paving 3,714 feet of 103rd. St., from S. Michigan Ave. to S. Cottage Grove Ave., in Chicago, Ill. Contract includes removal of one track of street car line, trolley poles and overhead wire.

CONDITIONS: Contractor to furnish all materials and complete work by December 1, 1942. Highway and water transportation facilities available. Wage rates are: skilled labor, $1.62½ to $2.00 per hr.; semi-skilled, $1.10 to $1.70; and common labor, $1.02½.

BIDS: Twelve bids were opened April 10, 1942, ranging from the low of $73,897 to $82,106.

LIST OF BIDDERS:

1. Ready Coal and Constr. Co., Chicago, Ill. (low)	$73,897
2. Chatham Paving Co., Chicago, Ill.	75,016
3. Standard Paving Co., Chicago, Ill.	75,570
4. James P. O'Keefe Co., Chicago, Ill.	75,735
5. States Improvement Co., Chicago, Ill.	75,922
6. Contracting & Material Co., Evanston, Ill.	76,364
7. H. G. Goelitz Co., Cicero, Ill.	76,718
8. Sensibar Engr. & Paving Co., Chicago, Ill.	76,739
9. Leininger Constr. Co., Chicago, Ill.	77,939
10. John A. McGarry & Co., Chicago, Ill.	78,258
11. James A. Sackley Co., Chicago, Ill.	78,767
12. J. A. Ross & Co., Chicago, Ill.	82,106

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Special excavation	7,150 c. y.	$0.65	$0.85	$0.90
2. Trench backfill	500 c. y.	1.20	.75	.75
3. 8-in. vit. tile pipe storm sew., type 2	720 l. f.	1.50	1.00	1.00
4. 8-in. vit. tile pipe storm sew., built in tunnel	80 l. f.	2.00	2.75	2.00
5. 10-in. vit. tile pipe storm sewers	130 l. f.	1.50	1.65	1.25
6. 8-in. cast iron pipe storm sewer	30 l. f.	3.50	3.00	10.00
7. New manholes—36-in., type 5, frame and lid	2 ea.	70.00	75.00	85.00
8. Manholes to be adjusted	19 ea.	7.00	8.00	15.00
9. Manholes to be reconstructed	18 ea.	20.00	17.00	20.00
10. New catchbasins, type A, 48-in., with T-5 frame and lid	30 ea.	75.00	77.00	95.00
11. Catchbasins, type A, 48-in. with exist. frame and lid	6 ea.	60.00	70.00	75.00
12. Catchbasins to be adjusted	5 ea.	7.00	8.00	15.00
13. Catchbasins to be reconstructed	5 ea.	20.00	17.00	25.00
14. Abandoned catchbasins and manholes cleaned, blocked and filled	60 ea.	5.00	5.00	4.00
15. Special inlets	4 ea.	30.00	35.00	50.00
16. Cast iron, type 5, frame and lid	47 ea.	25.00	22.00	21.00
17. Comb. conc. curb and gutter, type 3	7,100 l. f.	.71	.65	.71
18. Special concrete curb	40 l. f.	.71	.80	.71
19. Special concrete gutter	150 l. f.	.56	.70	.61
20. Special conc. curb and gutter	230 l. f.	1.21	1.25	1.50
21. Portland cement conc. sidewalk	11,500 s. f.	.20	.20	.30
22. Portland cement conc. step sidewalk	250 l. f.	.35	2.50	.50
23. Portland cement conc. driveway	100 s. y.	2.00	1.90	4.50
24. 1-in. premoulded expan. joint	1,100 s. f.	.14	.18	.21
25. Portland cement concrete pavement	18,400 s. y.	1.82	1.82	1.66
26. Granite block pavement	20 s. y.	7.00	7.50	9.00
27. Portland cement	9,250 bbl.	2.15	2.15	2.20
28. Black traffic marker	5,600 s. f.	.08	.08	.15

BRIDGES, TEXAS

OWNER: Texas State Highway Dept., Austin.

PROJECT: Construction of Lampasas River, Lampasas River Relief and Sulphur Creek Bridges between Kempner and Lampasas on U. S. Highway 190, in Lampasas County, Tex. Reinforced concrete girder type construction; length 0.144 miles; roadway width, 24-ft.

CONDITIONS: Contractor to furnish all materials and complete work in 130 working days. Rail and highway facilities available. Preference rating A-1-e requested. Wage rates are: skilled labor, $1.00 per hr.; semi-skilled, 50c.; common, 40c.

BIDS: Eight bids were received April 28, 1942, ranging from the contract low of $105,370 to $144,993.

LIST OF BIDDERS:

1. John F. Buckner, Cleburne, Tex. (contract)	$105,370
2. R. R. Tway, Oklahoma City, Okla	106,856
3. Ernest Loyd, Fort Worth, Tex	111,749
4. Cage Bros. & L. A. Turner, Bishop, Tex	112,505
5. W. S. Crawford, Dallas, Tex	113,885
6. Austin Bridge Co., Dallas, Tex	118,597
7. Ben Sira & Co., Dallas, Tex	127,629
8. Standard Paving Co., Fort Worth, Tex	144,993

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Unclassified channel excav.	298 c. y.	$0.50	$1.00	$1.00
2. Unclassified struct. excav.	514 c. y.	4.25	6.00	4.00
3. Class A concrete (slabs)	1,375 c. y.	24.90	26.00	25.00
4. Class A concrete (piers)	279.6 c. y.	23.10	24.00	26.00
5. Class A concrete (bents)	194 c. y.	24.95	24.00	26.00
6. Reinforcing steel	405,019 lb.	.0575	.055	.05½
7. Cast steel bearing plates	20,484 lb.	.21	.20	.22
8. Remove old structures (bridges)	2 ea.	1,200.00	2,250.00	2,800.00
9. 15-in. square precast conc. piling	1,608 l. f.	3.85	3.50	4.00
10. 16-in. octagon. precast conc. piling	3,070 l. f.	4.30	4.50	4.00
11. Railing (special, traffic)	970 l. f.	4.00	2.50	3.50
12. Railing (special, pedestrian)	554.5 l. f.	5.00	3.25	6.00
13. Dry riprap, type A	323 c. y.	4.00	5.00	5.00
14. Grouted riprap, type A	15 c. y.	9.25	10.00	12.00
15. Remove old structures (culvert)	1 ea.	35.00	50.00	100.00

HIGHWAY, WISCONSIN

OWNER: State Highway Comn. of Wisconsin, Madison; D. J. Minahan, division engineer.

PROJECT: Grading and construction of 7.41 miles of 20-ft. concrete pavement on U. S. Highway No. 12, about four miles north of Prairie du Sac. (Contract No. 2).

CONDITIONS: Contractor to furnish all materials and complete work in 125 working days. Rail and highway transportation facilities available. Wage rates are: skilled labor, 85c. to $1.50 per hr.; semi-skilled, 65c. to $1.50; and common, 65c. to $1.00.

BIDS: Three bids were received April 17, 1942, ranging from the contract low of $540,231 to $560,265.

LIST OF BIDDERS:

1. N. M. Isabella, Madison, Wis. (contract)	$540,231
2. L. G. Arnold, Inc., Eau Claire, Wis	542,624
3. J. R. Griffith Co., Racine, Wis	560,265

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clearing	104 sta.	$20.00	$20.00	$18.00
2. Grubbing	89 sta.	25.00	20.00	20.00
3. Remove concrete pavement	7,650 s. y.	.35	.30	.35
4. Unclassified excavation	127,267 c. y.	.57	.43	.48
5. Unclassified excavation	87,234 c. y.	.57	.88	1.15
6. Excavation, structures	260 c. y.	3.00	2.00	2.00
7. Borrow excavation	37,844 c. y.	.57	.54	.55
8. Finishing roadway	405 sta.	20.00	15.00	15.00
9. Obliterate old road	12 sta.	10.00	15.00	8.00
10. Concrete pavement	38,623 s. y.	2.68	2.54	2.40
11. Concrete surface drains	29 c. y.	40.00	25.00	15.00
12. Gravel or cr. stone, traf. bound surf. course	13,299 c. y.	1.50	1.50	1.45
13. Aggregate for gravel or cr. stone traf. bd. surf. crse in stockpiles	1,495 c. y.	1.50	1.45	1.40
14. Salvage surface course	5,400 s. y.	.09	.15	.16
15. Conc. masonry culvert	243 c. y.	25.00	28.00	28.00
16. Treated lumber and timber	2.3 Mbm.	175.00	185.00	150.00
17. Dry rubble masonry	482 c. y.	7.00	8.00	7.50
18. 24-in. rein. conc. culv. pipe	1,355 l. f.	3.75	4.00	3.75
19. 30-in. rein. conc. culv. pipe	127 l. f.	5.00	5.00	5.00
20. 36-in. rein. conc. culv. pipe	123 l. f.	6.40	6.00	6.50
21. 42-in. rein. conc. culv. pipe	239 l. f.	7.50	9.50	10.70
22. 48-in. rein. conc. culv. pipe	165 l. f.	9.20	10.50	11.00
23. Salvage 18-in. corr. galv. sheet metal culv. pipe	226 l. f.	1.25	1.00	1.25
24. Salv. 24-in. corr. galv. sheetmet. culv. pipe	290 l. f.	2.00	1.25	1.50
25. Temp. crossing (Sta.172C + 30)	L.S.	350.00	400.00	225.00
26. Temp. crossing (Sta. 238 + 67)	L.S.	350.00	500.00	225.00
27. Temp. crossing (Sta. 277 + 00)	L.S.	350.00	500.00	225.00
28. Temp. crossing (Sta. 315 + 00)	L.S.	350.00	500.00	225.00
29. Temp. crossing (Sta. 355 + 00)	L.S.	350.00	500.00	225.00
30. Temp. crossing (Sta. 395 + 65)	L.S.	350.00	500.00	225.00
31. Grouted rubble paving	80 s. y.	2.50	3.50	4.50
32. 12-in. rein. conc. culv. pipe, storm sewers	63 l. f.	2.50	3.00	3.00
33. Inlets, type A for 18-in. curb and gutter	2 ea.	55.00	50.00	35.00
34. Special curb and gutter	1,238 l. f.	2.10	2.10	2.00
35. Marker posts	121 ea.	2.50	2.25	2.00
36. Marker posts for rt.-of-way	109 ea.	2.50	2.25	2.00
37. Topsoil for seed beds and sodding	19,217 s. y.	.19	.15	.16
38. Salvage topsoil	32,047 s. y.	.16	.10	.10
39. Fertilizer	660 cwt.	3.50	5.00	5.00
40. Seeding	366,000 s. y.	.012	.015	.015
41. Sodding	19,217 s. y.	.32	.45	.40
42. Intercepting embankment	4,013 l. f.	.20	.75	.75
43. 18-in. culvert pipe	210 l. f.	1.75	2.50	2.00
44. 24-in. culvert pipe	136 l. f.	2.60	3.50	3.00
45. 30-in. culvert pipe	150 l. f.	3.00	4.60	4.00
46. Scale resistant concrete pavmt.	57,063 s. y.	2.68	2.65	2.50
47. HES scale resistant conc. pavmt.	14,457 s. y.	2.89	2.70	3.10
48. White conc. reflecting curb and gutter	3,084 l. f.	2.75	2.75	2.50

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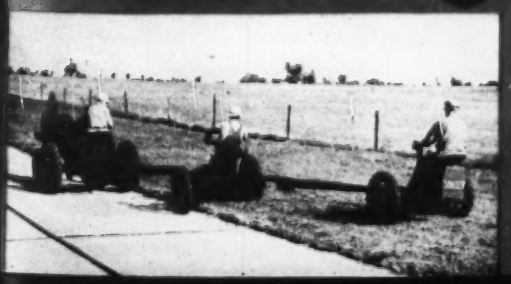

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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

INCREASED CONSTRUCTION labor rates provided the most important price change in June. Bricklayers' rates are up 2½c. per hour in Kansas City; 7½c. in Philadelphia; and 12½c. in Boston. Carpenters' wages are 12½c. per hour higher in Minneapolis, Kansas City and Boston. Structural ironworkers' rates climbed 12½c. in Cincinnati, and 15c. per hour in Boston. The Kansas City hoisting engineers' hourly rate, and the plasterers' rates are up 12½c. and 7½c., respectively.

Common labor on building work, and on heavy construction rose in Boston, Kansas City, Philadelphia, and Minneapolis.

Portland cement is up 5c. per barrel in New York, and up 4c. in Atlanta due to freight rate increases. Ready-mixed concrete is up in Atlanta and New York, but is off 25c. per cubic yard in Cleveland. Minor changes in iron and steel products are reported in San Francisco, Montreal and Kansas City.

Lumber prices were unusually steady, with the only major change being registered in Kansas City. Minor gains were also reported in Atlanta and Montreal. Structural clay tile prices climbed in Atlanta and Boston, and brick was up in Atlanta and New York.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT			SAND AND GRAVEL			CRUSHED STONE		CRUSHED SLAG		CONCRETE
	Per bbl., carload lots, including 40c per bbl. for bags, cash discount not deducted			Per ton, carload lots			Per ton, carload lots		Per ton, carload lots, f.o.b. plant		Ready Mixed 1:2:4, 50 c.y. or more, delivered
	Cloth Bags *a*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.59	$1.69	$8.04
Baltimore	2.36	2.11	1.91	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	7.25
Birmingham	2.50	2.25	.....	1.75	1.75	1.50	1.00	1.00	.90	1.15	5.80
Boston	2.75*b*	2.50*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	.....	.....	7.25*m*
Chicago	2.60	2.35	2.20	2.00‡*d*	2.00‡*d*	2.00‡*d*	2.00‡*d*	2.00‡*d*	1.50‡	1.50‡	.....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	.....	.....	6.60
Cleveland	2.39	2.14	.....	1.60*i*	1.60*i*	1.55*i*	2.05*i*	2.05*i*	1.70*i*	1.70*i*	7.45*i*
Dallas	2.52	2.27	2.07	1.75*p*	2.00*p*	1.25*p*	1.69*p*	1.84*p*	.....	.....	6.20
Denver	3.08	2.88	.....	1.20	1.40	.90	.....	.....	.....	.....	7.25
Detroit	2.40	2.15	1.95	1.50	1.60	1.10	2.25	2.25	2.00‡	2.00‡	6.50
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	.....	.....	7.50*o*
Los Angeles	2.80*o*	2.20*o*	.....	1.20	1.20	1.15	1.20*f*	1.20*f*	.....	.....	6.35
Minneapolis	2.90	2.65	.....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	.....	.....	7.35*j*
Montreal	.....	1.90*rs*	1.79*rs*	.....	.....	1.25‡*t*	.85‡*ct*	1.00‡*ct*	.....	.....	6.45*ls*
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	.....	.....	.....	.....	9.25
New York	2.60‡	2.35‡	.....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	.....	.....	7.25
Philadelphia	2.32	2.07	1.87	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	8.20*k*
Pittsburgh	2.44	2.19	1.99	1.40‡	1.40‡	1.70‡	2.25‡	2.25‡	1.50	1.50	8.25
St. Louis	2.80	2.52	.....	1.50‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*g*	.75*g*	8.00
San Francisco	.....*u*	2.21	1.81	1.36	1.36	1.36	1.46	1.46	.....	.....	7.55
Seattle	2.95*o*	2.70*o*	.....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	.....	.....	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Plus municipal tax. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount 35c. 500 to 2000; 70c. 2000 to 5000; 95c. over 5000. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u*. Price withdrawn. *v* 20c. per bbl. discount; 20c. allowed for returnable cloth bag.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn	$1.80	$1.75
Dallas, Tex. (Inc. 10c. tax)	1.85	1.80	Limedale, Ind	1.70	1.65	Steelton, Minn	1.80	1.75
Hannibal, Mo	1.70	1.65	Norfolk, Va	1.75	1.70	Universal, Pa	1.65	1.60
Hudson, N. Y	1.75	1.70	Northampton, Pa	1.55	1.50	Waco, Tex. (Plus 10c. tax in Tex.)	1.75	1.70
Independence, Kans	1.70	1.65	North Birmingham, Ala.	1.70	1.65	Montreal (8% sales tax incl.)	1.68	1.67

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICKS AND BLOCKS			PAVING ASPHALT		ASPHALT BINDERS—FLUXES		CUTBACK ASPHALT		ROAD OILS		ASPHALT EMULSION (Quick-breaking)
	Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3x4x8¼ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Per ton, less than 80 penetration		Per gal., 80-300 penetration		Per ton		Per gal.		Per gal.
				Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.40*e*	$24.62*e*	$0.0787*e*	$0.1309*e*	$0.0826*he*	$0.1348*h*	$0.0676*e*		$0.0826	$0.1348
Baltimore	145.00‡	45.00‡	3.00	15.00	21.00	.06	.09	13.00	23.00	.065		.07	.14
Birmingham	.....	32.00*j*	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.063		.09	.....†
Boston	85.00	55.00	3.75	14.00*	20.00*	.06*	.09*	.065*h*	.115*h*	.065*		.09‡*	.12‡*
Chicago	150.00	50.00	2.20*d*	14.80	20.80	13.00*g*	18.50*g*	.0625*h*	.15*h*	.05		.10	.14
Cincinnati	112.00	37.50	.....	16.40	.....	.085	.....	12.25	.....	.07		.085	.....
Cleveland	110.00	38.50	2.25	20.00	25.00	.09	.155	.105*h*	15.00	.07		.11	.15
Dallas	.....	36.00	....	13.25	20.30	.06	.103	16.00	24.80	.055		.05/.07	.07/.09
Denver	.....	27.50	....	.....	.....	.....	.....	.....	.....	.....		.....	.....
Detroit	.....	37.50	....	15.10*f*	22.60*f*	.0725	.1262	15.10	21.10	.067		.0725	.1262
Kansas City	.....	40.00	....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057		.11	.15
Los Angeles	.....	50.00	....	7.00*b*	16.00	7.00*bg*	16.00*bg*	7.00*b*	.....	.025		.0525	.1125
Minneapolis	.....	.....	1.87*d*	21.20	27.70	.....	.126	.....	32.64	.....		.....	.....
Montreal	.....	.....	....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*		.135*k*	.188*k*
New Orleans	.....	.....	....	13.00*a*	19.00*a*	.055	.085	.06*h*	.09*h*	.....		.078	.....
New York	.....	.....	....	16.40	23.50	.064	.124	.07*h*	.13*h*	.....		.0725	.1225
Philadelphia	130.00	56.50	3.96	14.00	.....	.055	.....	.065*h*	.....	.055		.065	.....
Pittsburgh	135.00	38.75	....	.....	.....	.....	.....	.....	.....	.....		.....	.....
St. Louis	.....	37.00	....	16.00	21.00	15.00*g*	21.00*g*	.0625*h*	.1125*h*	.05		.095	.1275
San Francisco	.....	70.00	....	9.50*m*	18.00*m*	9.50*gm*	18.00*gm*	10.00*m*	17.50*m*	9.50*gm*		.0525*m*	.1125*m*
Seattle	.....	60.00*c*	....	9.50*i*	25.85	.....	25.10*g*	10.00*i*	....*s*	9.50*i*		.0575*i*	.1308*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3¼x4x8¼ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction in interstate class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3¼x8¼ in. *k* Tax included. * May prices; none later available. † Available on priority only and quoted specially. *m* March prices latest available.

QUICK FACTS ON TRANSITE SEWER PIPE

FAST INSTALLATION . . . Transite's long lengths reduce the number of joints needed in the line . . . its light weight permits easier, faster, more economical handling.

LESS INFILTRATION . . . Fewer, tighter joints minimize leakage, cutting down on the load at the disposal plant.

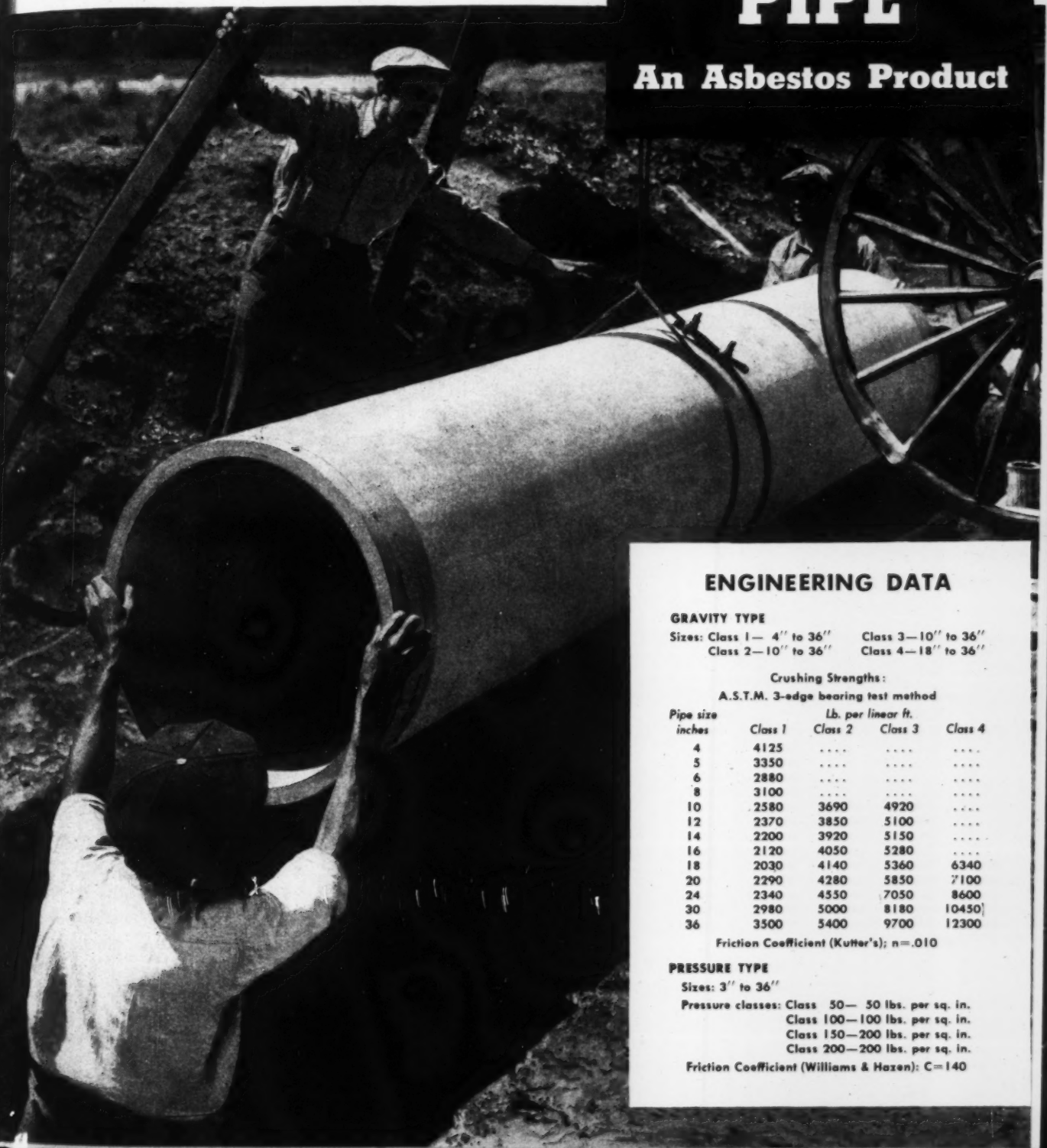
HIGH DELIVERY CAPACITY . . . This advantage of Transite Pipe frequently permits smaller pipe or flatter grades, resulting in shallower trenches.

AVAILABLE BOTH FOR FORCE MAINS AND GRAVITY LINES . . . Complete information is given in brochure TR-21A. And for details on lower-cost water transportation, send for Transite Water Pipe Brochure TR-11A. Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville

TRANSITE SEWER PIPE

An Asbestos Product



ENGINEERING DATA

GRAVITY TYPE

Sizes: Class 1— 4″ to 36″ Class 3—10″ to 36″
Class 2—10″ to 36″ Class 4—18″ to 36″

Crushing Strengths:

A.S.T.M. 3-edge bearing test method

Pipe size inches	*Lb. per linear ft.* Class 1	Class 2	Class 3	Class 4
4	4125	....	....	....
5	3350	....	....	....
6	2880	....	....	....
8	3100	....	....	....
10	2580	3690	4920	....
12	2370	3850	5100	....
14	2200	3920	5150	....
16	2120	4050	5280	....
18	2030	4140	5360	6340
20	2290	4280	5850	7100
24	2340	4550	7050	8600
30	2980	5000	8180	10450
36	3500	5400	9700	12300

Friction Coefficient (Kutter's); n=.010

PRESSURE TYPE

Sizes: 3″ to 36″

Pressure classes: Class 50— 50 lbs. per sq. in.
Class 100—100 lbs. per sq. in.
Class 150—200 lbs. per sq. in.
Class 200—200 lbs. per sq. in.

Friction Coefficient (Williams & Hazen): C=140

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¾-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	TRACK SUPPLIES: Angle Bars	Std. Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	4.75
Chicago	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15	.....
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....	.....
Detroit	.....	2.25‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.45*a*	2.50*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.80*a*	.....	.....	2.95*a*	.....	.....	.....	.....	.....	2.30	.....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates, alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per n.t.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¾ in., base price: 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq.yd., carload lots: Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 s.f., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd.	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.39	$2.39	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
Baltimore	3.70	2.90	2.75	.....	.10	30.00	32.00	1.70	1.27	.1611	3.00
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.50	1.80	1.34	.1701	.....
Boston	3.85	3.51	3.36	$20 C.L.	.10	18.50	29.50	1.76	1.31	.1656	2.70
Chicago	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.40
Cincinnati	3.68	2.53*cd*	2.53*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	.....
Cleveland	2.10*a*	2.15	2.15	.02½	.10	19.50	21.50	1.66	1.25	.1566	.....
Dallas	6.00	3.40	3.40	.....	.....	24.50	26.50	1.93	1.42	.1827	.....
Denver	4.35	3.95	3.80	.....	.....	26.50	28.50	1.97	1.45	.1863	.....
Detroit	3.65‡	2.34	2.24	.....	.10	22.00	24.00	1.68	1.26	.1584	2.66
Kansas City	4.00	2.64*cd*	2.64*cd*	.0	.05	19.60	23.60	1.78	1.33	.1683	2.89
Los Angeles	3.65*f*	3.32*j*	3.32*j*	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
Minneapolis	3.80‡	2.50*c*	2.50*c*	.0	.10	25.00	27.00	1.80	1.34	.1701	2.75*d*
Montreal	3.90*i*	2.65*i*	2.50*i*	.....	.....	26.00*hi*	33.00*hi*	2.58*i*	3.22*i*	.264*i*	.....
New Orleans	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1719	2.875
New York	3.75	2.76*c*	2.76*c*	.....	.15	17.50	19.50	1.76	1.32	.1665	2.74
Philadelphia	3.65	3.85	.....	.....	.....	19.50	21.50	1.71	1.28	.1611	2.74
Pittsburgh	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.40
St. Louis	3.69	2.39	2.39	.0	.05	28.00	34.00	1.69	1.27	.1602	2.70
San Francisco	4.35	2.75	2.60	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.85
Seattle	2.75*e*	2.50*e*	.....	.....	.....	34.50	38.50	1.93	1.42	.1827	2.95*ej*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* Increase due to all rail shipment route.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE Full standard weight, *k* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in.; Lap Weld Black %	Galv. %
Atlanta	$49.40	$0.26*b*	$0.468*bc*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	51.2
Baltimore	52.80	.35	.60	2.50	7.10	150.00	200.00	.45	1.60	65.5	57.5	63.0	54.5
Birmingham	45.00	.275	.495	1.95	5.50	100.00	220.00	.40	1.60	62.2	54.2	59.7	51.2
Boston	55.00	.26	.463	2.07	5.85	140.00	.....	.70	....	64.1	56.1	61.6	53.1
Chicago	53.80	.28	.54	2.25	6.25	100.00‡	150.00‡	.38	1.50	67.0	56.0	63.5	52.0
Cincinnati	52.70	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	65.9	57.9	63.4	54.9
Cleveland	54.24	.203	.3915	1.665	5.125	81.00	125.00	.38	1.60	67.8	59.8	65.3	56.8
Dallas	58.20	.305	.549	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3
Denver	60.60	.24†	.52†	2.16†	....	130.00	240.00	....	....	58.4	50.4	55.7	47.2
Detroit	54.24	.245	.4725	1.935	5.14	82.50	131.25	.35	1.50	66.3	58.3	63.8	55.3
Kansas City	55.12	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	62.9	54.9	60.0	51.5
Los Angeles	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	59.6	51.6	57.0	48.6
Minneapolis	59.00	.275†	.495†	1.98†	5.14†	.....	.....	.90	2.10	64.2	56.2	60.7	52.2
Montreal	60.00	.85	1.50	5.25	8.50*e*	135.00‡*l*	260.00‡*l*	.48*m*	1.92*m*	....	....	....	....
New Orleans	51.38	.26	.48	1.69	.....	150.00	220.00	.40	2.10	62.4	54.4	58.8	50.3
New York	52.20	.455	.8775	2.925	7.65	.....	.....	.50	1.20	64.9	56.8	62.4	53.9*i*
Philadelphia	.....	.28	.54	2.30	6.75	150.00	225.00	.45	1.75	56.4	42.6	53.3	38.9
Pittsburgh	55.60	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5
St. Louis	52.48	.28	.504	2.016	4.50	85.00	220.00	1.10*j*	1.80*k*	56.4	42.6	52.5	38.4
San Francisco	68.40	.3625*d*	.6525*d*	2.61	6.52	115.50	192.50	.54	3.30	45.0	31.0	47.0	34.5
Seattle	70.20	.375	.675	2.70	6.75	84.00	187.50	.45*f*	1.40*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ¾ in., 8½c.; 1 in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½ in.; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Tax included.

Has your Testing Equipment Kept Pace with your increased production?

In building our war machine, there must be no sacrifice of quality for speed. America must have not only the most, but also the best that its industries can produce. The physical properties of materials must be known by both producer and fabricator alike—specifications must be met, there can be no compromise.

It's easy to run fast, accurate tests on a recorder-equipped Southwark-Tate-Emery testing machine. A continuous-line stress-strain curve is plotted simultaneously with each test and complete tests, including records, can be made in as little as four minutes on routine work.

A wide variety of physical testing machines and instruments for both static and dynamic strain measurement and stress analysis is available from Baldwin Southwark in addition to the universal machine.

A complete listing and brief description of our equipment is available in Bulletin K-107. Write for your copy today.

BALDWIN

Southwark

BLW THE BALDWIN GROUP

DIVISION OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)												
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R2k	6x12 R2k	12x12 R2k	2x12 R2k	12x12 R2k	⅝"	¼"
Atlanta	**$29.00**	**$28.00**	**$29.00**	**$27.00**	**$28.00**	**$29.50**	**$40.00**	.....	.....	$60.00	$70.00	$17.90	$21.85
Baltimore	**40.00**	**41.00**	**41.00**	**39.00**	**39.00**	**41.00**	**56.00**	.....	.....	90.00	95.00	18.25	22.25
	45.00	*45.00*	*46.00*	*46.00*	*46.00*	*48.00*	*56.00*	*$60.00*	*$60.00*	.....	.....	.....	.....
Birmingham	**34.50**	**34.50**	**32.00**	**32.00**	**32.00**	**34.00**	**53.00**	**53.00**	**56.00**	.....	.....	17.35	21.15
[1]	37.50	37.50	37.00	37.00	37.00	43.00	65.00	.....	.....	67.50	70.00	.....	.....
Boston	‡* 70.00[2]	70.00[2]	60.00[3]	60.00[3]	77.00[4]	100.00[4]	115.00[4]	.....	.....	115.00	130.00	18.25	22.25
	‡* *55.00*	*55.00*	*60.00*	*65.00*	*65.00*	*80.00*	*85.00*	*85.00*	*85.00*	.....	.....	.....	.....
Chicago	**43.00**	**44.00**	**43.00**	**43.00**	**44.00**	**46.00**	**53.00**	.....	.....	90.00	100.00	14.60	17.80
	46.00	*46.00*	*46.00*	*44.00*	*46.00*	*48.00*	*50.00*	*55.00*	*55.00*	.....	.....	.....	.....
Cincinnati	**41.00**	**42.50**	**39.00**	**40.50**	**42.00**	**43.00**	**53.00**	.....	.....	65.00	68.00	17.35	21.15
	.....	.....	.....	.....	.....	.....	*55.50*	*55.50*	*55.50*	.....	.....	.....	.....
Cleveland	**42.50**	**42.50**	**41.50**	**43.50**	**45.00**	**48.00**	**53.00**	57.00	57.00	90.00	90.00	17.75	21.60
Dallas	*e* **39.50**	**40.50**	**39.50**	**38.00**	**38.50**	**39.50**	**53.00**	**53.00**	**53.00**	78.00	83.00	14.60	17.80
Denver	‡ 54.00[4]	52.00[4]	55.00[4]	55.00[4]	55.00[4]	56.00[4]	59.00[4]	*73.00*	*79.00*	.....	.....	10.45	12.70
Detroit	**46.00**	**46.00**	**46.00**	**46.00**	**46.00**	**48.00**	**53.00**	.....	.....	53.00	61.50	17.35	21.15
	.....	.....	.....	.....	.....	*51.50*	*54.00*	*60.00*	*60.00*	.....	.....	.....	.....
Kansas City	**50.00**	**55.00**	**54.00**	**54.00**	**54.00**	**56.00**	**70.00**	.....	.....	80.00	85.00	12.60	15.40
	50.00	*55.00*	*54.00*	*54.00*	*54.00*	*56.00*	*70.00*	*80.00*	*80.00*	.....	.....	.....	.....
Los Angeles	*a* *55.00*	*55.00*	*53.00*	*53.00*	*51.00*	*51.00*	*57.00*	*68.00*	*68.00*	.....	.....	9.90*gh*	12.05*gh*
Minneapolis	‡*b* 49.00[5]	49.00[5]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60	15.40
	‡ *53.00*	*53.00*	*53.00*	*52.00*	*52.00*	*53.00*	*59.00*	*61.00*	*61.00*	.....	.....	.....	.....
Montreal	†‡ *43.00*	*46.00*	*42.00*	*45.00*	*47.00*	*54.00*	.....	.....	.....	200.00	200.00	.....	.....
	42.50	*42.50*	*45.25*	*47.25*	*48.25*	*46.75*	*60.75*	*60.75*	*60.75*	.....	.....	.....	.....
New Orleans	**31.50**	**31.50**	**33.75**	**31.75**	**34.00**	**35.00**	**48.00**	.....	.....	69.00	69.00	14.60	17.80
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	.....	.....
New York	‡ **48.00**	**49.00**	**49.00**	**50.00**	**51.00**	**54.00**	**62.00**	.....	.....	120.00*f*	125.00*f*	18.35	22.25
	‡	.....	*65.00*	*65.00*	*65.00*	*65.00*	*67.50*	*75.00*	*75.00*	.....	.....	.....	.....
Philadelphia	**43.00**	**44.00**	**43.00**	**43.00**	**44.00**	**47.00**	**49.00**	.....	.....	75.00	80.00	18.25	22.25
	47.00	*47.00*	*47.00*	*47.00*	*46.50*	*46.25*	*56.00*	*68.00*	*68.00*	.....	.....	.....	.....
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	.....	.....	.....	.....	18.10	22.05
	69.20	*68.10*	*66.10*	*65.30*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	.....	.....	.....	.....
St. Louis	‡*c* **45.00**	**46.50**	**44.50**	**42.50**	**43.50**	**45.00**	**59.00**	*67.50*	*67.50*	78.00	66.00	14.60	17.80
San Francisco	*d* *35.50*	*35.50*	*38.00*	*38.00*	*37.50*	*37.50*	*43.00*	*43.00*	*43.00*	.....	.....	7.30*g*	8.90*g*
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [6] Spruce. [7] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

NOTE: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ⅝", $86.50; on ¾", $95.30; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by water shipment. *h* 50,000 lb. minimum.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 — Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*
	A quality	B quality	
Atlanta	75%	75%	$0.15
Baltimore	79%	80%	.15
Birmingham	76%	76%	.105
Boston	77%	78%	.15
Chicago	77%	77%	.15
Cincinnati	77–10%	77–10%	.15
Cleveland	77%	77%	.19
Dallas	78%	78%	.1625
Denver	76%	76%	.155*e*
Detroit	79%	79%	.15
Kansas City	76–10%	76–10%	.155
Los Angeles	86%*d*	88%*d*	.1575
Minneapolis	76%	76%	.155
Montreal	40–5%‡	47%‡	.1675†
New Orleans	70%	75%	.16
New York	81%	82%	.22*f*
Philadelphia	78%	79%	.15
Pittsburgh	79%	79%	.1225
St. Louis	76–10%	76–10%	.155
San Francisco	78%	80%	.155
Seattle	75%	76%	.1575†

Price of 60% Ammonia Gelatin in $0.01 per lb. higher than 40%

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers' list Sept. 15, 1928. ‡ Plus sales tax.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES — F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered from barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf — Barge	Short Leaf — Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.23	$0.26
12 in. — 2 ft. from butt	6 in.	50 to 59 ft.	.26	.28
12 in. — 2 ft. from butt	6 in.	60 to 69 ft.	.27	.29
14 in. — 2 ft. from butt	6 in.	50 to 69 ft.	.28	.29
14 in. — 2 ft. from butt	6 in.	70 to 79 ft.	.31	.33
14 in. — 2 ft. from butt	5 in.	80 to 85 ft.	.40	.44
14 in. — 2 ft. from butt	5 in.	85 to 89 ft.	.45	.482

RAILWAY TIES

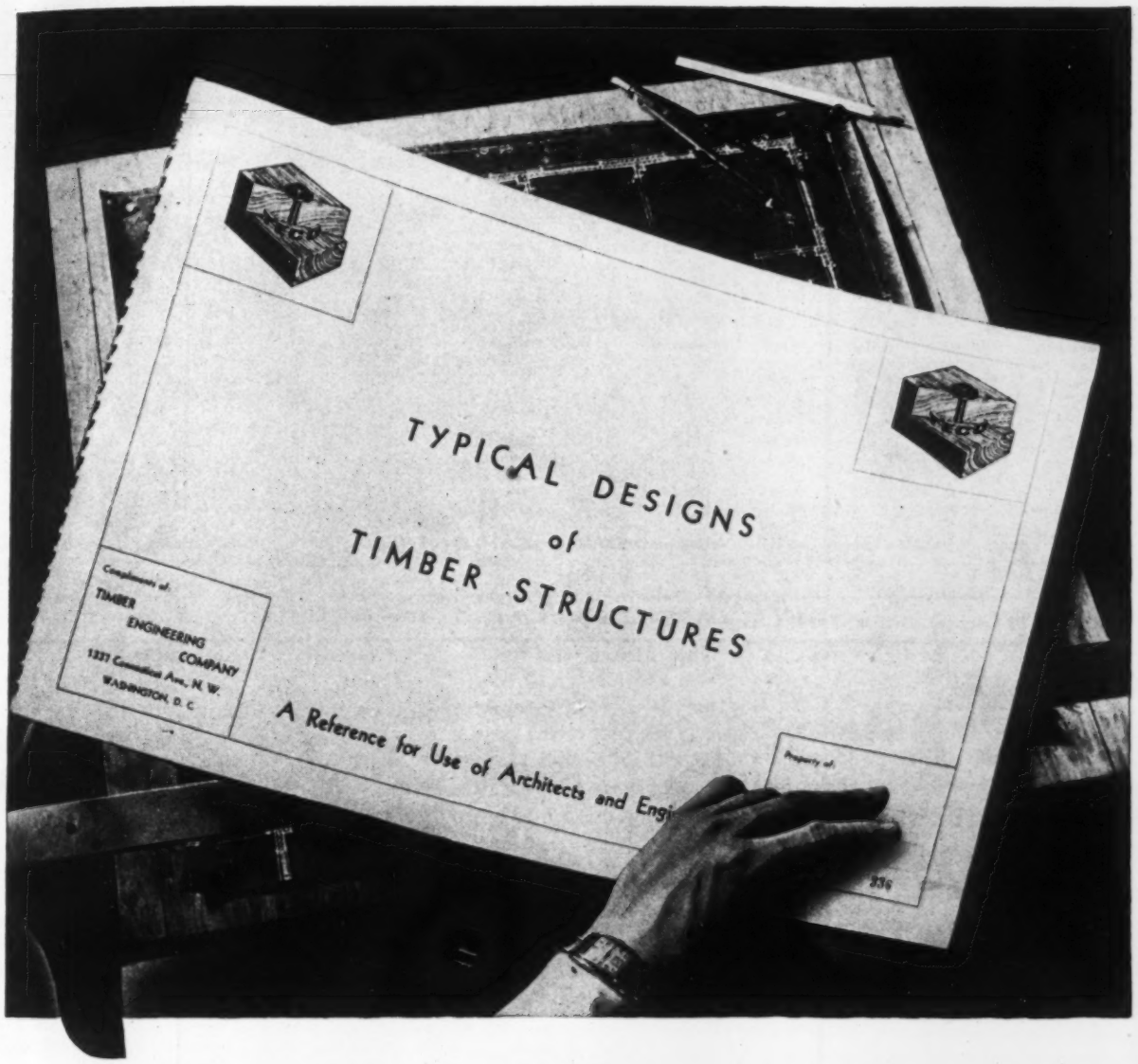
Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.30	.....	$1.80	.....
	Pine	1.60	$2.40*a*	2.40	$3.40*a*
New York	S. L. Sap Pine	1.30 /1.40	2.35	1.60	2.60
	Mixed Oak	1.55	2.35	2.00	2.95
Birmingham	White Oak	1.00	1.60*a*	1.30	2.25*a*
	Southern Pine	.....	.....	.....	.....
Chicago	Red Oak	.....	2.40*a*	.....	3.00*a*
	Southern Pine	.....	.....	.....	.....
Los Angeles*	Douglas Fir	1.10	1.75*a*	1.60	2.50*a*
Philadelphia	Red Oak	.....	2.10*a*	.....	3.25*a*
St. Louis	White Oak	1.65	.....	1.90	.....
	Red Oak	1.55	2.15*a*	1.90	2.70*a*
	Sap Pine or Cypress	1.45	.....	1.80	.....
San Francisco	Douglas Fir	1.25*bef*	.....	.....	3.00*af*
Montreal	Birch or Maple	.85	....†	.95	....†

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 6" x 8" x 8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* At ships tackle. † Out of market.

CHEMICALS

Water, sewage treatment road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.25–3.10
Chlorine cylinders, liquid, per lb. delivered	0525
Calcium chloride, 77–80%, flaked, in 400-lb. drums or 100-lb. paper bags, delivered, per ton	18.50–35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00–25.00
Sulphate of copper, in bbl., per 100-lb	5.15–5.50



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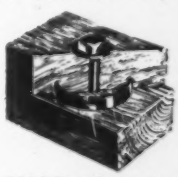

TECO Ring Connectors spread the load on a timber joint over practically the entire cross-section of the wood.

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STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE — PARTITION — SCORED			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED			BRICK		LIME		
	Per M. lots of 2,000 pieces or over,			Per M. lots of 2,000 pieces or over,			Per M. in quantity.		Per ton,	In paper,	Carload lot,
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverized or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$244.00	$13.54	$18.04	$26.54	$15.04	$15.04
Baltimore	82.00	88.00	165.00	195.00	260.00	320.00	14.00*k*	17.00*k*	18.00	12.00	50*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	35*le*
Boston	89.35*a*	93.30*a*	178.70*a*	202.50	271.80	308.20	18.00*i*	21.00*i*	20.00	14.00	17.00
Chicago	68.10	72.60	135.90	185.70	234.90	268.10	12.00	14.00	17.00	15.00	13.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	17.50	17.50	15.40	12.90	
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	14.50*j*	13.25*j*	3.00*jm*
Dallas	52.00	54.00	100.00	135.00	200.00	263.00	11.50*i*	13.50*i*	19.00	15.60	95*n*
Denver	84.80	94.40	152.70	178.20	212.00	227.90	13.50	17.00	30.00*j*	19.00*j*	30.00*j*
Detroit	78.20	86.40	159.60	203.00	263.50	301.00*e*	17.50	18.00	16.50	13.90	14.90
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	16.00	24.00	19.32	13.00	10.92
Los Angeles	73.50*tr*	89.50*tr*	128.00*ctr*	210.00*tr*	368.00*tr*	460.00*tr*	13.50	15.00	16.50	17.50	17.50
Minneapolis	81.00*b*	86.40*b*	146.90*b*	.....	177.00*b*	246.00*b*	13.60	15.60*g*	21.00	16.00	19.00
Montreal	72.20*au*	77.50*au*	142.50*au*	76.00*atu*	165.80*au*	248.70*u*	22.00*tu*	27.25*tu*	23.50*u*	17.00*u*	12.00*u*
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	14.50	.....	20.00	14.00	17.00
Philadelphia	90.00	97.70	183.20	197.10	243.20	301.10	17.00*s*	20.00*s*	15.50*q*	8.55*q*	10.55*q*
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2.55*m*
St. Louis	62.00	88.00	120.00	180.00	234.00	280.00	17.00	18.00	22.00	18.00	18.00
San Francisco	84.00	94.50	225.00	.....	.....	.....	17.50	22.00	20.00	20.00	16.40
Seattle	105.00	115.00	210.00	.....	.....	.....	19.50*f*	20.50*f*	20.00*s*	20.00*s*	20.00*s*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* 50c. per M. off for cash. *j* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb. *n* Per sack 100 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *q* 25-ton cars. *r* 5% discount 10 days. *s* 2% off cash. *t* 5½x8x12. *u* Plus 8% sales tax.

PAINT, ROOFING—F.O.B. CARLOAD LOTS

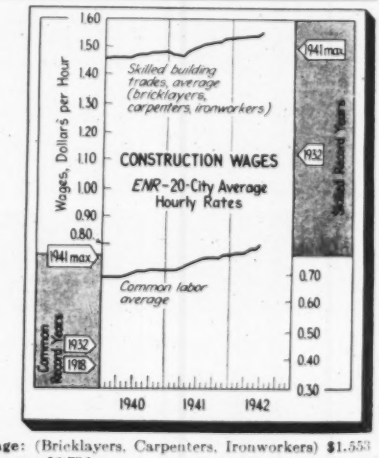
	RED LEAD	WHITE LEAD	READY-MIXED PAINT			ROOFING SUPPLIES Carload lots f.o.b. factory				
	Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	Per 100 lb. in oil	Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	30.00
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.04	1.97	1.97	.32	28.35
Boston	10.00	13.75	2.70‡	3.65‡	2.50‡	1.90‡	1.90*h*‡	1.90*h*‡	.50‡	20.00‡
Chicago	10.00	13.75	2.11	2.63	1.72	1.75*hf*	1.66*hf*	1.66*hf*	.28*f*	23.00*f*
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	21.00
Cleveland	10.00	13.75	2.90	4.80	2.30	1.93	1.83*h*	1.83*h*	.40	25.00
Dallas	10.00	14.50	1.88	2.11*n*	.....	2.30*h*	2.25*h*	2.45*h*	.35	39.00
Denver	10.50	14.25	1.65	2.60	.27*l*	2.45	3.15	3.15	.35	28.00
Detroit	10.00	13.75	2.00	3.00	1.60	2.40	2.50	2.50	.35	22.00
Kansas City	10.00	13.875	2.39*g*	2.55*gr*	2.16*gn*	2.10	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	.....	.45	.....
Minneapolis	10.00	13.875	.....	.....	.....	1.75*i*	1.66*hi*	1.66*hi*	.32	23.00
Montreal	9.25	11.07	2.40*p*	2.97*p*	2.51*p*	2.85	2.58	2.07	.63	1.85*e*
New York	10.00	13.75	2.05	2.55	1.64	1.66	1.58*h*	1.58*h*	.26	25.00
Philadelphia	10.00	13.75	.....	.....	.....	1.75	1.66	1.66	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
St. Louis	10.00	13.75	.....	.....	.....	1.75	1.66	1.66	.34	24.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.10/2.00	1.71	2.40	2.40	.33	19.50
Seattle	10.25	14.25	1.90	3.00	.....	2.15	2.16*h*	.....	.35	26.50*j*

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 lb. *l* Per lb. *m* Per bbl. *n* May, 1941 price, no later quotation available. *p* Plus 8% sales tax. *r* Not available, except on priority rating; then quoted specially.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const
Atlanta	$1.375	$1.00	$1.375	$1.00/1.25	$1.25	$0.40	$0.50
Baltimore	1.625	1.375	1.65	1.65	1.50	.70	.70
Birmingham	1.75	1.125/1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.25/1.625	1.25/1.50	1.50/1.65	1.25/1.875	1.25/1.667	.80/1.00	.80/1.00
Chicago	1.70	1.625	1.70	1.70	1.825	1.025	1.025
Cincinnati	1.75	1.50	1.625	1.40/1.55	1.625	.80	.80
Cleveland	1.75	1.50	1.75	1.75	1.75	1.00	1.00
Dallas	1.50	1.00	1.25	1.00	1.50	.50/.625	.50/.625
Denver	1.65*b*	1.43*b*	1.43*b*	1.43*b*	1.51*b*	.718*b*	.718*b*
Detroit	1.60	1.40	1.75	1.625	1.675	.80	.80
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.55
Los Angeles	1.50	1.175	1.50	1.50	1.667	.75	.75
Minneapolis	1.50	1.375	1.50	1.40	1.50*e*	.925	.925
New Orleans	1.50	1.25	1.50	1.375	1.375	.60	.60
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*c*	1.031	.95
Philadelphia	1.90	1.50	1.80	1.65	1.8775	.825	.825
Pittsburgh	1.90	1.50	1.75	1.5625/1.625	1.75	.80	.70
St. Louis	1.25/1.50	1.50	1.75	1.50/2.00	1.25/1.75	.675/.875	.875
San Francisco	1.75*c*	1.375	1.60	1.50	1.667*c*	.875	.875
Seattle	1.715	1.415	1.615	1.565	1.715	1.015	1.10
Montreal	.965	.855	.87	.76	.945	.505	.505

b 7 hr. day. *c* 6 hr. day. *d* 35 hr. wk. *e* 30 hr. wk.



ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.553
ENR Common Average: $0.796

YOU can help build more War Supplies

BY ITS VERY NATURE, the dirt-moving business has always been a race against time, a battle against the elements. Now it is necessary to speed-up even more. Rush your contracts through ahead of schedule! The sooner you finish your project, the sooner its final objective can be realized — the more planes, ships, guns . . . machines, parts and supplies there will be! There are many ways of cutting corners . . . clipping seconds off this job, minutes off that one. Your job short cuts, and ways of making your machines last longer, will help the other fellow help his country . . . likewise, his ideas will help you. Why not exchange this information? Send your suggestions to us. To encourage this, we will pay for those used in our ads. Start 'em coming . . . NOW!

PROVEN JOB SHORT CUTS

Use your reserve tractors as pushers. The pusher-loading method enables you to haul more material per trip, cut loading time ½ to ⅓ and reduce the wear and tear on your machines.

• • •

Load your scrapers downhill, wherever possible . . . it's quicker and much easier on your equipment.

• • •

Do your culvert pipe excavating with your 2-wheel scraper and 2-Cycle Diesel tractor . . . or with a Hough Shovel and WM tractor. Either machine will finish up the job in a fraction of usual time.

• • •

Handle your clearing with Allis-Chalmers tractors equipped with Carco winches. It's simple to run a winch line into an inaccessible area, attach the cable, and pull out the trees and stumps.

• • •

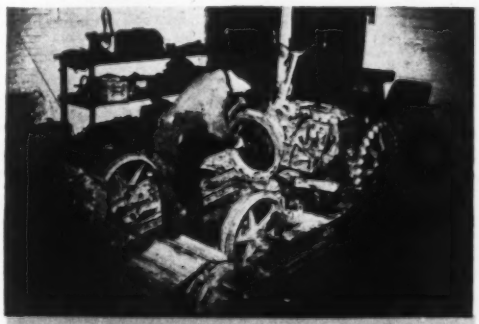
When finishing, windrow your loose rock with your Model AD Motor Grader or Leaning Frame Grader, then pick it up with your four-wheel Gar Wood scraper. Does a fast, clean job.

WIN $5

Allis-Chalmers Will Pay $5 For Each Suggestion Accepted For Publication In Future Advertisements . . . on

1. Job Short Cuts (like examples you have just read.)
2. How To Make Tractors and Graders Last Longer.

Use as many words as necessary to tell your story. Illustrate, if you wish. Awards will be based on the value of the suggestions, not on literary style. Everybody eligible.

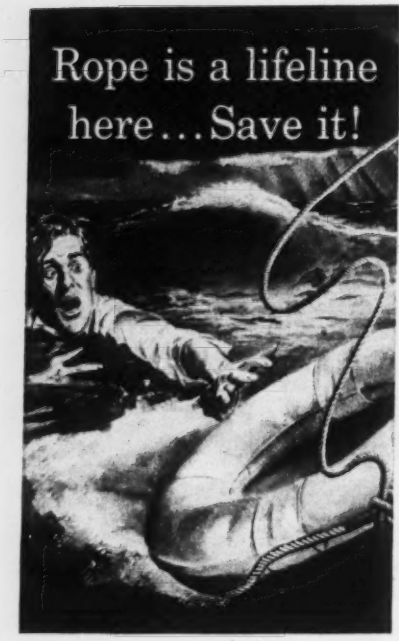


KEEP 'EM ROLLING

Keep your equipment in first-class condition. Your Allis-Chalmers dealer is fully equipped to give you A-1 service on repairs, parts, rebuilding jobs. He may have good buys on used machines, too. Keep in touch with him.

INVEST IN VICTORY . . . BUY WAR SAVINGS BONDS AND STAMPS

ALLIS-CHALMERS *Power for Victory!*



ARE YOU AMONG THOSE WHO CAN HELP SAVE ROPE?

"MAN OVERBOARD!" That's just one instance where rope is vitally needed. Shipments of food, planes, tanks, troops —all depend on rope. Like aluminum, rubber and tin, rope is a basic war need.

THE SUPPLY is limited. We have been cut off from the sources of Manila fiber supply needed for Manila Rope. Even with the production of emergency grades of rope, there is none to spare. Save rope we must. As you read this, you may discover a way to help.

PLYMOUTH CORDAGE COMPANY offers a booklet called "Making Rope Last Longer." It shows ways of reducing rope wear. Also safety rules for workers' protection.

ARE YOU in a position to pass this information along to those who handle rope? If the answer is yes, you are urged to send for the free booklet. Your action may save many pounds of all-important rope. Plymouth Cordage Company, North Plymouth, Massachusetts *and* Welland, Ontario.

PLYMOUTH

THE *Rope* YOU CAN TRUST

Plymouth Cordage Company
Dept. ENR-6-4
North Plymouth, Massachusetts
Please send your free booklet, "Making Rope Last Longer."

Name.....
Firm.....
Address.....
.....

New Engineering Books

(*Continued from p.* 95)

A MANUAL OF THE SLIDE RULE—Fourth Printing. By J. E. Thompson. 220 pp. D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York City. Price $1.75.

MECHANICS OF FLUIDS—By Glenn Murphy. 321 pp. International Textbook Co., Scranton, Pa.

MEMORIA PRESENTADA AL CONGRESO NACIONAL — Por El Antonio Flores Vega. Secretario De Estado En El Despacho De Fomento Y Anexos. Managua, Nicaragua.

Reports and Pamphlets

OUR PUBLIC WORKS EXPERIENCE—National Resources Planning Board. Superintendent of Documents, Washington, D. C. Price 10c.

PAPERS PRESENTED AT THE HIGHWAY CONFERENCE HELD AT THE UNIVERSITY OF COLORADO JAN. 8-9, 1942—C. L. Eckel, Head of the Department of Civil Engineering, University of Colorado, Boulder, Colo.

EFFECT OF RANGE OF STRESS ON THE FATIGUE STRENGTH OF METALS—By James O. Smith. Engineering Experiment Station Series No. 334. University of Illinois, Urbana. Price 55c.

JOINT INVESTIGATION OF FISSURES IN RAILROAD RAILS—Eighth progress report. By Herbert F. Moore. Engineering Experiment Station Reprint Series No. 22. University of Illinois, Urbana. Price 15c.

LUMINESCENT COATINGS—Report of Sub-Committee No. 43 of the New York Paint and Varnish Production Club. (Joseph Mattiello, 42 Stewart Ave., Brooklyn.)

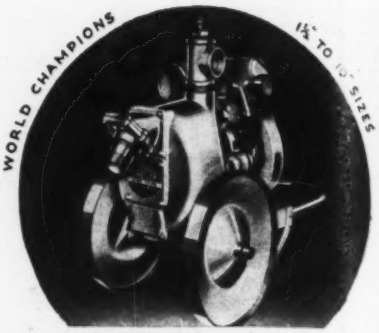
A REVIEW OF RAILWAY OPERATIONS IN 1941—Special Series No. 71. Association of American Railroads, Bureau of Railway Economics, Washington, D. C.

BUILDING MATERIALS AND STRUCTURES—Report BMS80. Performance Test of Floor Coverings for Use in Low-Cost Housing: Part 4. By Percy A. Sigler and and Elmer A. Koerner. Superintendent of Documents, Washington, D. C. Price 15c.

PROCEEDINGS OF THE WAR CONSTRUCTION FORUM — Defense Highway Congress. Bulletin No. 80. American Road Builders' Association, International Bldg., Washington, D. C.

1942 LAWS BULLETIN NO. 1—A Digest of New Legislation Affecting Highway Users. National Highway Users Conference, National Press Building, Washington, D. C.

(*Continued on p.* 112)



Only JAEGER Pumps Have All These Features

- **JAEGER PRIMING JET** — Up to 5 times faster prime and re-prime — no adjustments, no need to "gun" engine.
- **POSITIVE RECIRCULATION CUT-OFF** — controlled by flow, not pressure.
- **LONG-LIFE SEAL** — Accessible for inspection.
- **PATENTED SELF-CLEANING SHELL.**
- **EVERY PUMP FACTORY TESTED** for high capacity and pressure.
- **COMPLETE RANGE OF SIZES, TYPES** — 3,000 to 220,000 g.p.h.

Send Today for Latest Catalog and Prices.

THE JAEGER MACHINE CO
200 Dublin Ave., Columbus, Ohio

Now!

BETTER, SMOOTHER HARDER, STRONGER CONCRETE SURFACES

with

CELOTEX

ABSORPTIVE FORM LINER

CELOTEX Absorptive Form Liner removes excess water and trapped air from concrete, producing a smooth, dense, hard outer layer. Better appearance, greater durability, greater abrasion resistance are some of the results! Successfully used on dams, aqueducts, bridge piers, docks, stadia, etc.

WRITE FOR FACTS!

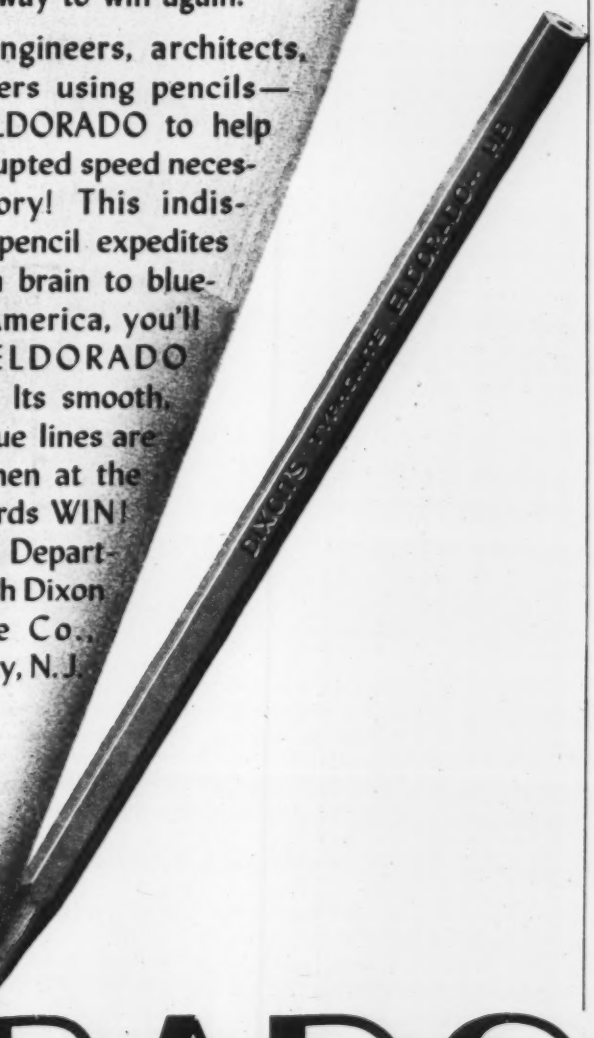
The word Celotex is a brand name identifying a group of products marketed by The Celotex Corporation.

THE CELOTEX CORPORATION
CHICAGO

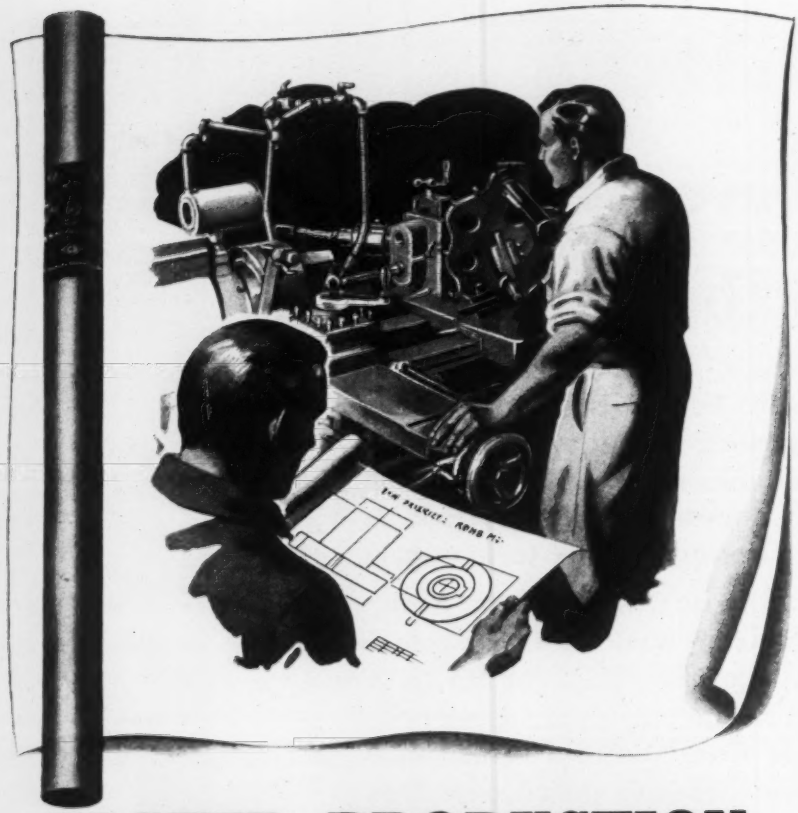
Coming events cast their shadows . . .

Victory often hides behind the appearance of defeat! Things looked gloomy at Valley Forge and when the Huns were within 23 miles of Paris 1914! But we've always won . . . and despite Pearl Harbor, Java and the rest . . . we're on the way to win again.

Today American engineers, architects, draftsmen—war workers using pencils—call upon *Typhonite* ELDORADO to help maintain the uninterrupted speed necessary for final Victory! This indispensable drawing pencil expedites defense plans from brain to blueprint. All over America, you'll find *Typhonite* ELDORADO in good hands. Its smooth, unfailing opaque lines are helping the men at the drawing boards WIN! Pencil Sales Department, Joseph Dixon Crucible Co., Jersey City, N. J.



ELDORADO



FASTER PRODUCTION
in every roll

PRODUCTION *starts* on the drafting board. Here is where the *wrong* kind of tracing cloth can slow up your operations . . . and where the *right* kind can help speed them. In thousands of drafting rooms today, production is getting off to a faster start because of Bruning Rival Tracing Cloth . . . the tracing cloth preferred by experienced draftsmen.

Rival has perfect uniformity of surface—which means no blemishes to hinder the draftsman's work. Rival is famous for its easy erasing—no time lost in eliminating smudges and troublesome "ghosts." Rival has a superior and lasting transparency not obtained with oils or wax—which means clearer, readable prints always. And Rival has exceptionally high tensile strength and durability to eliminate costly re-tracing.

We'd like to send you a sample of Rival—so that you can see and judge it for yourself. Find out why—and how—Bruning Rival can help *your* draftsmen win the battle for speed. Charles Bruning Co., Inc.

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SPEEDS—SIMPLIFIES—AND PROTECTS A NATION'S DRAFTING

Reports and Pamphlets

(*Continued from p.* 110)

BETTER CITIES—By Charles S. Ascher. National Resources Planning Board, Washington, D. C.

AUTOMOBILE TRANSPORTATION IN THE WAR EFFORT—By Charles L. Dearing. Pamphlet No. 37. The Brookings Institution, Washington, D. C. Price 25c.

PROCEEDINGS OF THE HYDROLOGY CONFERENCE—Held at State College, Pennsylvania. Bulletin No. 27. Price $2.

CALCULUS FOR PRACTICAL ENGINEERS IN A SIMPLE, QUICK ENGINEERING WAY—By Alois Cibulka. Hemphill's Book Store, Austin, Texas. $3.

PROPOSED POST-WAR PROGRAM—The city of New York, F. H. LaGuardia, Mayor. Prepared by the City Planning Commission, Municipal Building. Price 25c.

SOIL MECHANICS AND FOUNDATION ENGINEERING—Proceedings of the Fifth Annual Conference. Part 1 and 2. The University of Texas, College of Engineering and Bureau of Engineering Research, Austin, Texas.

A PLAN FOR THE CONSERVATION OF VITAL WAR TRANSPORTATION — Published by Automotive Safety Foundation, Washington, D. C., in cooperation with the Office of Defense Transportation.

TWO-SPAN CONTINUOUS BEAMS WITH DEAD LOADS—A. A. Jakkula. Engineering Experiment Station Series No. 58. Texas Engineering Experiment Station, College Station, Texas.

PROGRESS REPORT OF WPA PROGRAM—June 30, 1941. Federal Works Agency, Work Projects Administration.

A COURSE IN MODERN TIMBER ENGINEERING—Howard J. Hansen. Southern Pine Association, New Orleans. Free to interested parties.

WARTIME PROTECTION FOR PUBLIC WORKS—Reprinted from *Public Works*, 310 East 45th St., New York.

WAYNE COUNTY, MICHIGAN—Thirty-Fifth Annual Report of the Board of County Road Commissioners. 1941.

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA—Third Annual Report 1941.

VIRGINIA—Thirty-Third Annual Report, State Department of Health, Commonwealth of Virginia. 1941.

ILLINOIS—Twenty-Fourth Annual Report, Illinois Commerce Commission. Centennial Building, Springfield, Ill.

THE ENGINEERING FOUNDATION—Annual Report 1941. Engineering Societies Building, New York.

Efficient speed is a civil as well as a military objective, today. In planning a water supply line the conservation of time and labor is of paramount importance. The ease and speed with which Lock Joint Reinforced Concrete Pipe can be installed are qualities which align themselves with those of durability and economy.

Sturdy, long lasting Lock Joint pipes are fabricated right on the job and by special curing operations can be laid within a few days after manufacture. By adapting pipe design to closely conform to hydraulic and operating conditions, the Lock Joint Pipe Company performs another important service—the conservation of war-essential materials.

In planning your pipeline project, look to the future while keeping one eye focused on the demands of the times. Conserve time, labor and material. Specify Lock Joint Reinforced Concrete Pipe.

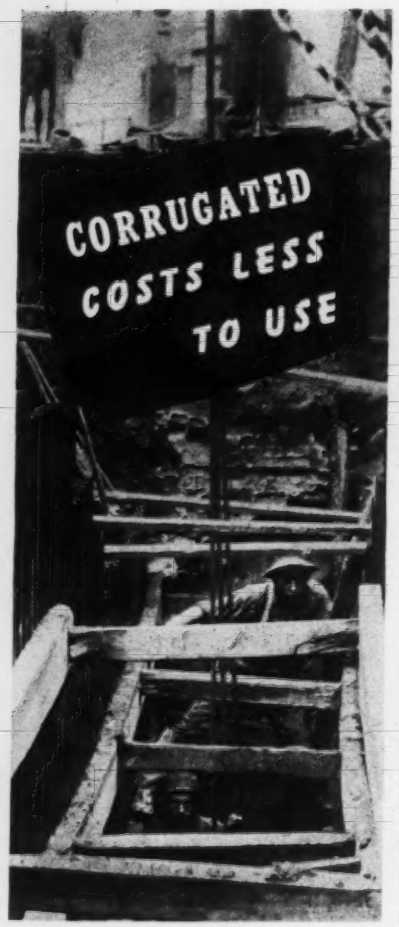
SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY
Established 1905
AMPERE • NEW JERSEY

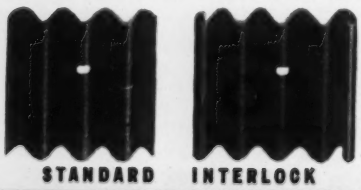
Denver, Colo. • Chicago, Ill.
Kenilworth, N. J. • Kansas City, Mo.
Rock Island, Ill. • White Plains, N. Y.
Valley Park, Mo. • Cleveland, Ohio
Hartford, Conn. • Navarre, Ohio



COMPUTED on a cost per job basis over the long life of Corrugated Steel Sheet Piling, the economy of this superior piling becomes evident.

Light in weight, it saves handling and transportation costs. Easy to install, it saves power and labor cost. Easy to salvage and reuse, it spreads its initial cost over so many installations it eventually almost ceases to be an expense factor. Send for specification book today.

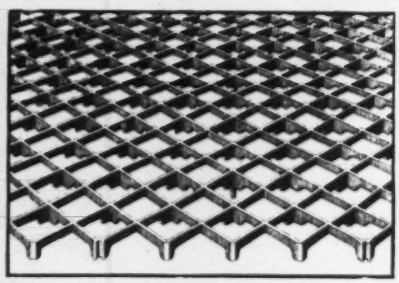
CAINE STEEL CO.
1820 N. Central Ave., Chicago



CAINE
ROLLED STEEL
SHEET PILING

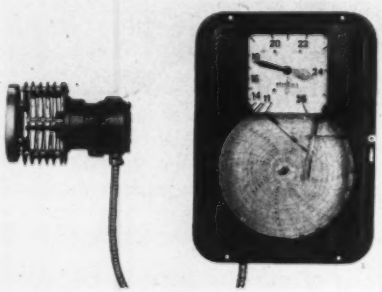
New Aids to the Constructor

Equipment and material announcements and manufacturers' news



Floor Grid

"Seelauton" floor grids, made of special alloy grey iron castings in standard sizes 1 ft. 6 in. by 3 ft. are manufactured by the Seelauton Co. for all types of concrete flooring subject to heavy wear as boiler plants, foundries, loading platforms, ramps, industrial trucking aisles, etc. Through practical engineering tests, this grid has been developed to assure non-cupping when filled with cement. It prevents cracking, breaking and disintegrating of floors subject to heavy loads. The grid is equally usable for old or new floors and its finished surface makes it a natural anti-skid surface.—*The Seelauton Co., Inc., 2500 W. 27th St., Cleveland, Ohio.*



Pyrometer

A new radiation pyrometer, known as Pyrovac, has been developed by the engineers of The Bristol Company. This new instrument is designed for recording, indicating or automatically controlling temperatures in furnaces and kilns above 900 deg. F. The temperature-sensitive unit or radiation head is mounted on the outside of the furnace out of the hot zone where it picks up heat rays emitted from the object under measurement, thus registering the surface temperature.—*The Bristol Company, Waterbury, Conn.*

Protective Coating

A protective coating reported to be immune to all acids and all alkalis in any concentration and at any working temperature has been developed under the name of "Chempruf". The product may be used for coating or lining, for plating and acid tanks, fume ducts, storage and processing tanks and all surfaces including ceramics that must be protected against destructive reagents. Softening point is 300 F and the melting point is 510 F. Manufacturers say that this coating may be found a substitute for rubber and the synthetics that surpasses anything that has been done. However, "Chempruf" is not immune to mineral solvents, oils and greases. The product comes in two types, "A", being a brush-on heavy liquid that can be applied by any workman, and "B", a plastic that hardens to withstand heavy-duty service and is applied only by the firm's own experts in their plant or on location. —*Protective Coatings, Incorporated, Detroit, Mich.*

Network Wiring

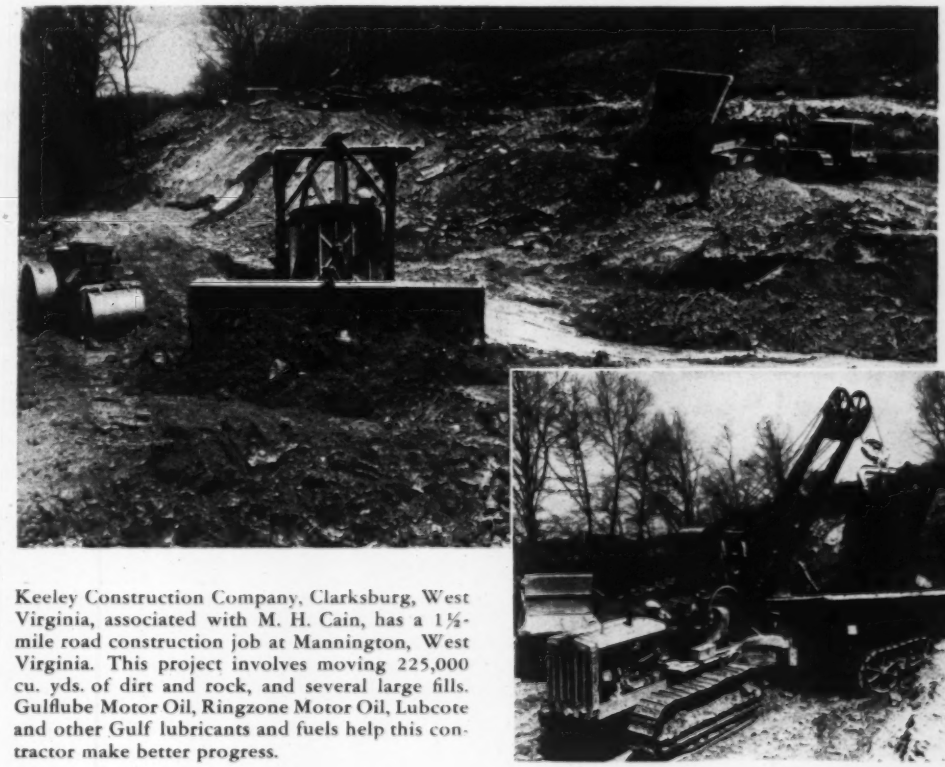
Newly developed fittings and installation methods make possible an entirely new and simplified network type of electric wiring installation utilizing basic Wiremold No. 3000 raceway and taking off with other Wiremold raceways to provide complete surface wiring layout for lighting and portable tool or appliance power outlets in production areas, engineering departments, laboratories and plant office buildings. Rigidity of Wiremold No. 3000 channel and special Wiremold hanger fittings permit spanning of beams. Minimum number of Wiremold "slip joint" fittings cover all installation methods and requirements. Simplified layouts use minimum of steel and other scarce materials.—*The Wiremold Co., Hartford, Conn.*

Radio Control

The Barber-Colman Co., manufacturers

"GULF has helped us get ahead of contract schedule"

. . . says highway contractor



Keeley Construction Company, Clarksburg, West Virginia, associated with M. H. Cain, has a 1½-mile road construction job at Mannington, West Virginia. This project involves moving 225,000 cu. yds. of dirt and rock, and several large fills. Gulflube Motor Oil, Ringzone Motor Oil, Lubcote and other Gulf lubricants and fuels help this contractor make better progress.

"The efficient and dependable performance of our equipment with Gulf Lubricants and Fuels are important factors in our rapid progress."

"A LARGE share of the credit for our fast pace on this tough job is due to Gulf lubricants and fuels," says the contractor on this road construction project. "For with these Gulf products we get efficient, dependable performance from all our equipment, and extra hours of trouble-free operation."

Leading contractors on projects of every kind depend on Gulf quality lubricants and fuels to help them beat contract schedules. For they have learned from experience that proper lubrication and top-notch fuel performance result in more efficient operation of equipment, fewer delays from mechanical troubles, and less expense for maintenance and repairs.

You, too, will find it pays to use Gulf quality products on your next contract. They are quickly available to you through more than 1200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today. GULF OIL CORPORATION — GULF REFINING COMPANY, *Gulf Building, Pittsburgh, Pennsylvania.*

GULF

OIL IS AMMUNITION — — USE IT WISELY!

★ West Dodd lightning protection and static control equipment is being widely used in all parts of the country to help safeguard ammunition loading lines, underground ammunition magazines, standard ammunition magazines and bag loading buildings.

The chance of lightning halting, or slowing up, vital war production is also eliminated in many industrial plants by West Dodd protection of the power stack.

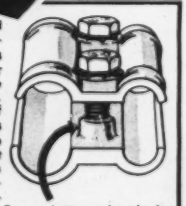
THE PLUS FACTORS

In the two vital factors of experience and responsibility, West Dodd provides a plus. For West Dodd is a consolidation of the 12 largest manufacturers in the field, including the pioneers of *approved* lightning protection, with the wealth of their experience in all phases of the work. Thus a contract with West Dodd is an assurance of prompt delivery, complete cooperation and satisfactory application.

FULLY APPROVED

West Dodd materials and methods of installation are passed by the National Board of Fire Underwriters', American Institute of Electrical Engineers, and other competent authorities. Conductors, points, bus terminals, connectors, point supports, ground plates, and other accessories produced by West Dodd are inspected and labeled in the plant by Underwriters' Laboratories, Inc.

West Dodd will render full assistance in planning the installation and estimating costs. Write or wire, today.



The exclusive West Dodd easy-on, solderless, bonding clamp. Note how boss provides greater number threads so screw slippage is practically eliminated. This clamp is one of many West Dodd features especially developed to meet U. S. Government requirements. Eliminates hand wrapping and soldering. Is quicker to install. More permanent. Forms better electrical bond. Made of copper-bronze, tinned when necessary to prevent electrolitic corrosion. 16 sizes.

WEST DODD
LIGHTNING CONDUCTOR CORP.
A RELIABLE PROTECTION AGAINST A LEADING CAUSE OF FIRE
D/S
GOSHEN, INDIANA

of operating equipment for doors and gates, has announced that the latest application of its radio control for doors and gates has been made to shop trucks as shown in the above photograph. The radio transmitter is connected to the battery supplying the truck power in such a way that only 6 volts are in the circuit, and it is operated by self-restoring, normally open, push button located on the steering rod of the truck. The transmitting coil is mounted underneath the lift platform. As the truck passes over the receiving coil upon approaching the closed door, the driver pushes a button. The frequency signal is carried to the receiver in the building where a relay opens the door. While passing over a second receiving coil, the driver again pushes the button, closing and locking the door. —*Barber-Colman Co., Rockford, Ill.*

Paper for Concrete Piers

The Sonoco Products Company has developed a spiral wound laminated paper tube for use as pier forms for concrete in cantonment type construction work. Advantages include the fact that forms may be easily stripped off and the piers set up, or they may be left on the piers indefinitely. The same amount of concrete as is handled with other types of forms may be used, the paper being rigid and strong enough to handle great volumes. Tubes, supplied in 24-ft. lengths and five diameters and may be cut to length on the job. The tubes are wax-treated both inside and out. Principal advantage claimed is the elimination of costly form construction and heavy bracings needed on other types of concrete forms. A special tripping tool has been developed by the company to simplify surface operations on the form. — *The Sonoco Products Company, Hartsville, S. C.*

Metal Shaper

A new 7 in. metal shaper is being introduced by the Porter-Cable Machine Co. It is a self-contained motor driven unit with motor and speed change control mounted in the floor pedestal. For smoother operation, this shaper has sprocket and chain drive, and an extra heavy crank pin plate keeps chatter to a minimum. Six cross feeds are obtainable from 0.002 to 0.012. Weight is approximately 485 pounds, and it requires

Contractors Handling Construction Contracts vital to our All-Out War Effort are using large numbers of "99M" Power Graders to complete jobs days or weeks ahead of schedule.

MAKING THE GRADE
On High Speed War Production

● Because the "99M" Power Grader handles bigger loads, can work under conditions that stall ordinary 2-wheel drive motor graders, and provides a number of very practical attachments that eliminate the need for much auxiliary equipment, it is unmatched for high speed handling of war jobs.

The superior performance of the "99M" is the result of powerful all-wheel drive, power operated steer on all four wheels, power blade shift, and maximum *working* weight. You'll move more dirt and move it faster with a "99M". This is true whether the work is in clay, sand, gravel, mud or loose soil...whether the footing is slippery, sloping, loose, irregular or rough.

For full facts on the help a "99M" and its attachments can give you in making the grade on high speed war construction, write for Bulletin 1946.

THE AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Illinois

MOTOR GRADERS • BLADE GRADERS • ELEVATING GRADERS • SCRAPERS • CRUSHING AND SCREENING PLANTS • ROLLERS
ROLL-A-PLANES • MOTOR SWEEPERS • SHOVELS AND CRANES • SCARIFIERS • DUMP CARS • TRAIL CARS

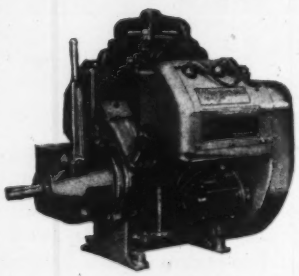
Need a new material that's a real PINCH HITTER?
Perhaps Douglas Fir Plywood can be of service to you!
● If your war production blueprints call for materials you can't obtain . . . or if you're looking for a new structural material that gives superior performance . . . investigate Douglas Fir Plywood. This "modern miracle in wood" is helping scores of industries maintain schedules, turn out more work and improve their products. Perhaps it can help you, too, in crating and boxes, in housing workers or in countless other ways. Its large sizes, light weight, great strength, durability and split-proofness may be advantages you need. So write today for free Industrial Handbook or technical assistance. Douglas Fir Plywood Association 1682 Tacoma, Building, Tacoma, Washington.
DOUGLAS FIR PLYWOOD
Real Lumber
MADE LARGER, LIGHTER
SPLIT-PROOF
STRONGER
POUND FOR POUND STRONGER THAN STEEL!

HEAVY-DUTY POWER as Dependable as AIR

Wherever men and machines work, there is always plenty of AIR. Wherever Wisconsin heavy-duty air-cooled engines work, there are no "water stops"; no lay-ups or delays for servicing water-cooling parts or mechanism.

Designed for efficient operation at extremely high temperatures (or frigidly cold temperatures), Wisconsin air-cooled engines are helping to maintain the highest productive capacity of which Men and Machines are capable.

Let Wisconsin-powered equipment work for you, too.



Wisconsin Engines are made in a full range of types and sizes, 1 and 4 cylinder, 1 to 35 hp. Model VE-4 22 hp. illustrated.

MOST POWER Per POUND

WISCONSIN MOTOR Corporation

MILWAUKEE, WISCONSIN, U. S. A.

World's Largest Builders of Heavy-Duty Air-Cooled Engines

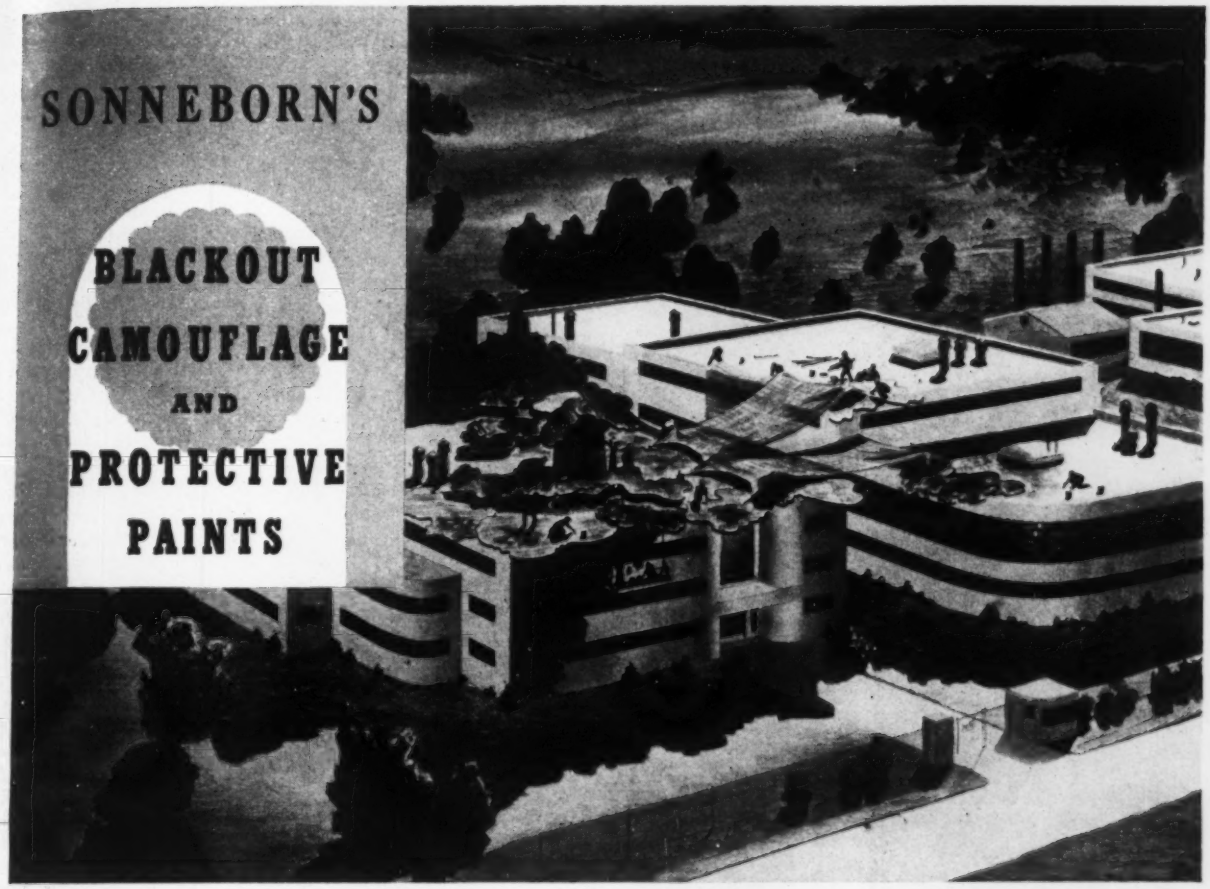
floor space 14 in. long by 19 in.—*Porter-Cable Machine Co., Syracuse, N. Y.*

Power Saw

A new high-speed DeWalt metal cut-off saw especially designed for cutting gates and risers from bronze and aluminum castings, has just been brought out. The machine is powered with a 10 hp., 2,400 r.p.m. geared electric motor, totally inclosed, fan cooled, and hung vertically in its yoke, permitting the cutting wheel to operate horizontally. Chain feed is provided to give the operator complete control of the cutting wheel at all times. Shown above is another new DeWalt product, a small metal cutting power saw, equipped with a 5 hp. motor and capable of cutting ferrous and non-ferrous bar stock up to 1½ in., light weight steel tubing up to 4 in. and extruded or small structural shapes up to 4 in. on a side. —*DeWalt Products Corp., Lancaster, Pa.*

Hard-Facing Rods

To serve companies unable to furnish high priority ratings, the Stoody Co. has developed two new hard-facing alloys which are being marketed under the trade names of Stoodite K and Stoody Self-Hardening K. Stoodite K is a cast hard-facing rod consisting principally of molybdenum, tungsten, manganese, silicon, carbon and iron. It is supplied both in bare form for oxyacetylene application and in coated form for d.c. electric application. Stoodite K is recommended for hard-facing various types of agricultural tools, cement mill parts, brick and clay equipment, dredging and excavating equipment, etc. Self-Hardening K is com-



For Protection that's DOUBLY NECESSARY now

Protecting buildings and equipment against the ravages of weather has always been common-sense economy. It is a downright necessity now that facilities of all kinds be kept at their best for the duration. And today's needs call for special provision for security—through blackout and camouflage.

Sonneborn's Blackout and Camouflage paints meet this twofold need fully—economically. Because they are basically protective coatings, they afford protection against weather and other sources of corrosion. *They meet Government requirements as to opacity and non-reflecting qualities assuring a minimum of light-reflection and are available in colors which reflect only the longer infra-red radiations and absorb most of the incident light.* The range of finishes has been expanded to include types required to complete defense contracts for various Government agencies. Masonry, wood, glass, metal, etc. are among the surfaces to which these are applicable.

Write today for full details on Sonneborn Blackout and Camouflage paints, and get your copy of the New Building Products Catalogue.

Where Results Count—Count on Sonneborn

L. SONNEBORN SONS, Inc.

88 LEXINGTON AVENUE, NEW YORK, N. Y.

SONNEBORN MAINTENANCE HELPS INCLUDE

Caulking Compounds—airproof, non-shrinking, waterproof, elastic; in bulk or for cartridge use.

Floor Treatments—designed to protect concrete, terrazzo, linoleum, composition and wood floors. New and old surfaces.

Paints—Varnishes—Enamels—protective coatings—for masonry, wood, metal; floor and desk varnishes.

Roof Coatings—designed for economical repair and lasting protection; Stormtight—a quality product in use for many years.

Waterproofing—above and below grade; colorless treatment for exterior walls.

Waxes—floor waxes, rubless or buffing types; liquid and paste; also colored waxes.

VICTORY ★ NEEDS ★ VOLUME ★

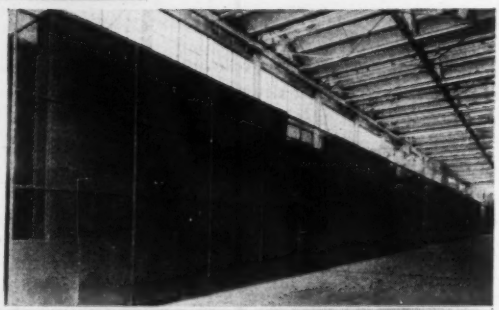
Steelcrete

DIAMOND MESH
Is a Double ^ v

To obtain *Victory* we need *Volume*. To obtain Volume we must protect our *Materials* and *Man-Power*. Production Volume can't wait on accidents. Workers, Plant, Parts must have every safeguard. Steelcrete Expanded Metal DIAMOND MESHES *double* the safety factor wherever used. Available in a wide range of styles, with a full line of framing materials and accessories for easy fabrication.

"IT'S WHEELING STEEL"

WRITE FOR
FREE HAND BOOK



OTHER Steelcrete PRODUCTS *to Accelerate Victory*

EXPANDED METAL GUARDS for Men and Machines
EXPANDED METAL GUARDS for Windows and Doors
EXPANDED METAL MESH for Partitions and Enclosures
EXPANDED METAL WALKWAY MESH for Catwalks, etc.

THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Quick Shipments from 14 Warehouses

posed principally of molybdenum, manganese, silicon, carbon, vanadium and iron, and is supplied both for oxyacetylene and electric application. It is recommended for hard facing tractor parts, sheepsfoot tamper shoes, roll crushers, jaw crushers, gyratory crusher heads, conveyor buckets and similar equipment. —*Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.*

Solving Conversion Problems

The Watson-Standard Company has announced the development of a series of lacquers especially adapted to the conversion from tin or terne plate to black plate. These new lacquers, developed over a period of several months, have unusual properties of adhesion to the black plate, and prevent under-film corrosion. The new series includes lacquers developed to withstand processing for home canning. One of the outstanding features of the lacquers is the fact that they can be made in metallic colors, thus solving an important problem of decoration.—*Watson-Standard Company, Pittsburgh, Pa.*

Radial Saw

The American Saw Mill Machinery Co. has announced the new Monarch radial saw "The Streamliner" designed to meet needs of utmost speed and efficiency in production. The machine has a number of new mechanical features which further simplify its operation. Capacity of cross-cutting has been considerably increased in all standard models to take care of the widest panelboard, 32 roller bearings in the ram housing assure light-pressure precision travel of the saw, easy operation and reduction of wear to a minimum. A spring bumper on the ram housing cushions the back stroke and assists in starting the forward motion of the saw. The adjustable crank-feed bar, which mechanically controls the saw travel for heavy dado work and other difficult cuts, is another unique feature.—*The American Saw Mill Machinery Co., Hackettstown, N. J.*

Generator

A new revolving armature type generator has been developed by the Kato Engineering Co. for use on either 110 volt or 110/220 three wire service. The design is available with three phase, three wire and three phase four wire, the latter permitting operating three phase equipment and single phase equipment may be operated by connecting from the fourth wire to any one of the three phase wires. The generators have exceptionally good motor starting capacity, all a.c. and d.c. brushes are easily accessible for inspection.—*Kato Engineering Co., 530 No. Front St., Mankato, Minn.*

LARGE SKIP AREA

Special baffle plates at skip sides protect paver and operator from cement sand and gravel.

Wide skip permits easy and quick spotting of loaded batch trucks.

Large skip area provides sufficient space, without crowding, for maximum batch.

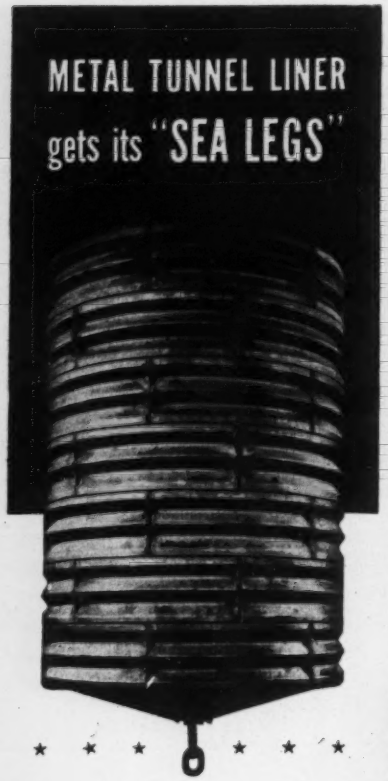
EASY AND QUICK BATCH SPOTTING

High speed pouring requires high speed in every operation. Important operation in the batch cycle is the loading of the skip. Koehring Paver skips are large, streamlined, without corners, designed for flow-line charging, wide enough for easy entrance of batch truck tires. Skips have sufficient area to hold the maximum size batch without crowding. Heavy plate construction with replaceable liners and tire tread plates assure a rigid unit for batch truck loading.

KOEHRING COMPANY
MILWAUKEE • WISCONSIN

KOEHRING K HEAVY DUTY

HEAVY-DUTY CONSTRUCTION EQUIPMENT



War is changing the shape of steel. Now it is tanks, planes and guns instead of peacetime products. Occasionally, as in this Navy buoy, you'll recognize an old familiar friend. It's a wartime, nautical version of ARMCO Tunnel Liner Plates.

Perhaps it will help remind you how much ARMCO Liner Plates will some day contribute to easier, safer tunneling. Gage for gage, ARMCO heavy duty liner is stronger (section modulus) than any other plate. On a strength—weight basis it costs less at the start. Work moves fast because one man handles the light sections and only structural wrenches are needed for assembly. Where completed rings can be spaced to take advantage of partly self-supporting ground, you may actually buy fewer plates.

Remember that after the war ARMCO Liner Plates will be back — better than ever before — to help you cut costs and speed tunnel work. Armco Drainage Products Association, 605 Curtis Street, Middletown, Ohio.

ARMCO
TUNNEL LINER PLATES

Manufacturer's Activities

Personnel changes and new plans

Employees and the management of the LINCOLN ELECTRIC Co. recently made a contribution of $8,000 to Greater Cleveland's fund to buy a bomber for MacArthur. Workers in the plant raised $4,000 by a voluntary subscription program, and JAMES F. LINCOLN (right), president of the company, added $4,000 as a personal gift to match the contributions of his employees. Mr. Lincoln praised the spirit of his employees in taking time out from their strenuous war production efforts to organize committees to collect the money.

E. W. JACKSON, formerly service manager for the CATERPILLAR TRACTOR COMPANY has been made assistant to the president. Mr. Jackson had been general service manager since January, 1937. C. O. NASH, formerly manager of the service development division and of the service engineering division succeeds Mr. Jackson as general service manager.

Five of the larger construction companies in North Dakota have pooled their personnel and equipment into a new corporation, the SIX BUILDERS, INC. Firms included are T. F. POWERS CONSTRUCTION Co., of Fargo; MEINECKE & JOHNSON CO., of Fargo; J. H. MACKLEY CO., of Minot; I. E. ORHEIM, of Minot, and E. A. MOLINE, of Jamestown.

EDWIN OLIVER BENNETT, chief petroleum engineer for the CONTINENTAL OIL CO., was awarded the Hanlon award for outstanding individual contribution and achievement in the natural gas industry, at a recent banquet in Tulsa sponsored by the Natural Gasoline Association of America.

L. A. S. WOOD, chief lighting engineer for the WESTINGHOUSE ELECTRIC & MFG. CO., died recently after a short illness. Born in London, England, Mr. Wood took a leading part in planning street lighting systems in larger European cities, and on his arrival in the United States in 1911, introduced the flame carbon arc lamp for use in this country. He served as consultant on lighting for the recent Chicago exposition and the Great Lakes exposition at Cleveland, Ohio.

A. S. SHAFTER, secretary-treasurer of the UNITED STATES MANUFACTURING CO., of Decatur, Ill., has been appointed special assistant to Philip D. Reed, chief of the Bureau of Industry Branches of the War Production Board.

CHARLES M. SCHOENLAUB, formerly assistant superintendent of the open hearth

The AIRTEMP DIVISION of the CHRYSLER CORP., at Dayton, Ohio, recently received the Minute Man flag for employee participation in a county drive for the purchase of U. S. war bonds. Under a payroll deduction plan, 100 percent of the employees participated in the bond purchase. Above, JENNIE SMITH, president of the Chrysler Airtemp Girls Club, makes an acceptance speech after the flag was presented by W. A. Keyes, chairman of the drive.

department, Republic Steel Corp., at Cleveland, O., has been named acting chief of the Production Requirements Branch, War Production Board.

DAN F. SERVEY, 55, president of the HAYDITE CORP., died at Kansas City May 16.

The BLAW-KNOX CO., of Pittsburgh, Pa., through its local offices and sixty-five nation-wide distributors, has announced a plan for utilizing and conserving vital equipment by asking contractors owning idle equipment and contractors in need of such equipment to use the Blaw-Knox Company's organization as a medium for exchange of the machinery.

ROBERT W. GILLISPIE, president of the JEFFREY MANUFACTURING CO., of Columbus, Ohio, is shown making an acceptance speech after his firm was awarded the coveted Navy "E" burgee for work done to aid the war effort. Hundreds of the plant's workers attended the ceremonies, held in the company's shop after naval officers had made an inspection tour of the plant.

K. S. ADAMS, president of the PHILLIPS PETROLEUM CO., has announced that his organization will build two plants for the production of synthetic rubber. One of the plants will manufacture butadiene and the other styrene. Locations are secret, but Mr. Adams said that the plants will be financed by the government but will be designed and engineered by Phillips employees.

DONALD H. MCNEAL, formerly deputy general manager of the Home Owners' Loan Corp. and technical director of the Federal Home Loan Bank Board has been appointed assistant to the President of the JAMES STEWART CO., INC., contractors.

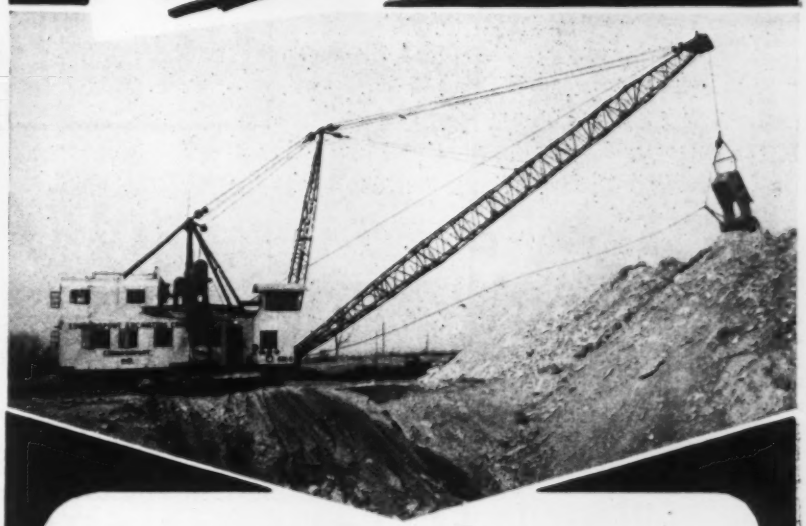
JAMES CUMMINGS BARR, 75, for many years New England district sales manager of the RAIL JOINT CO., INC., with headquarters at Boston, died at Palm Beach, Fla., recently.

CHARLES A. GREENE, formerly vice-president of VALENTINE & CO., has become vice-president of PAINT ENGINEERS, INC.

FRANCIS J. BURTT has been appointed director of public relations for the AMERICAN STEEL AND WIRE CO., succeeding E. W. Kempton who recently transferred to the parent company, UNITED STATES STEEL CORP., at Pittsburgh, Pa.

PAGE TWO-ENGINE DIESEL-POWERED WALKING DRAGLINE

GETS THE LAG OUT!



FAST HOIST—FAST SWING AT THE SAME TIME...

● Even when the load of swinging is added to that of hoisting . . . a Page Two-Engine Dragline doesn't "pull down" or "lag." This smooth flow of balanced power is possible by having one engine for HOISTING, only—and another separate engine for SWINGING, only. Thus the speed of both swing and hoist remains constant. The result: Precious seconds saved on every cycle . . . MORE DIRT MOVED PER SHIFT! For information about Page Draglines on the job, clip the coupon below and MAIL IT TODAY!

PAGE ENGINEERING COMPANY
Clearing Post Office, Chicago, Ill.

PAGE Two Engine DRAGLINES

Address this coupon to
Dept. M-44
PAGE ENGINEERING CO., Chicago, Ill.
Mail a copy of your new folder "Page Walking Draglines On the Job" with NO obligation to us.

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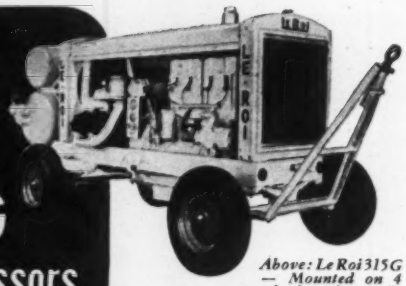
Le Roi-engineered for

speed-economy—

LE ROI 315 G

Portable Air Compressors



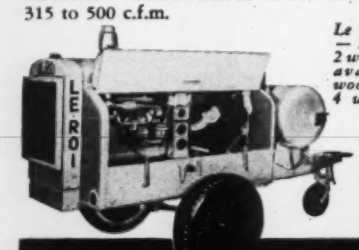
Above: Le Roi 315G — Mounted on 4 wheels—also available on wood skids. 315 c.f.m.

Built by the *only* manufacturer of *both* engine and compressor. Quickly towed *to* the job; easily moved about *on* the job. Valve-in-head engine easily accessible, to reduce "down time." • Big capacity for long-time, low-cost, continuous heavy-duty service. Write for descriptive Bulletin 62G-1 and ask for Form S-183 showing how many tools you can operate from this 315 c.f.m. machine. • Other sizes 60 to 500 c.f.m. Diesel models 315 to 500 c.f.m.

Some points to remember in ordering air compressors:

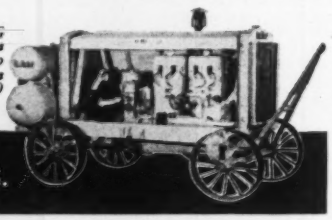
To do your part for Uncle Sam, specify steel wheels or wood skids instead of pneumatic tires, where practical—thus help save rubber.

Please be patient with delivery delays made necessary by the urgency of war orders.



Le Roi 105GV — Mounted on 2 wheels — also available on wood skids or 4 wheels. 105 c.f.m.

Le Roi 210G — Mounted on 4 wheels — also available on wood skids. 210 c.f.m.

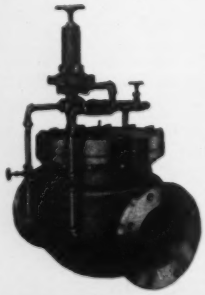


LE ROI COMPANY • MILWAUKEE, WIS.

Water Pressure Relief Valve

On excess pressure, due to line surges or excess pumping head, this valve automatically opens to dissipate necessary water volume to maintain desired line pressure. The valve is arranged either with atmospheric pilot valve exhaust or self-contained, according to service conditions and requirements.

Valves may be arranged to open at abnormal pressures and held open under subnormal pressures until the surge subsides, and then close when normal conditions prevail.



Sizes: 3" to 36"

Angle and Globe Patterns

Write for Specifications.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

IT'S FIT FOR ANY SHIP!

FROM sail boat to battleship you will find Electroline-Fiege Wire Rope Connectors wherever positive, permanent wire rope connections are vital. They are first choice wherever wire rope is used.

They are simple, streamlined and strong, easy to install and make a connection that cannot fail. Made in many types and sizes to fill your needs exactly.

If increased wire rope life interests you, you will write today for complete descriptive literature and see for yourself the better features that make this connector a favorite wherever wire rope is used.

★ ★ ★ ★

Electroline FIEGE CONNECTORS

Electroline Company
4033 South La Salle Street Chicago, Illinois

MEETINGS

ASSOCIATED EQUIPMENT DISTRIBUTORS, 23rd semi-annual meeting, Edgewater Beach Hotel, Chicago, Ill., June 8–10.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Spring Board meeting, Stevens Hotel, Chicago, Ill., June 8–9.

AMERICAN WATER WORKS ASSOCIATION, Stevens Hotel, Chicago, June 21–25.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, 50th annual meeting, Columbia University, New York City, June 29–July 2.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, University of Minnesota, Minneapolis, Minn., July 22–23.

REGIONAL AND LOCAL MEETINGS

ENGINEERING SOCIETY OF DETROIT, annual meeting, Horace H. Rackham Educational Memorial, Detroit, Mich., June 10.

CENTRAL STATES SEWAGE WORKS ASSOCIATION, annual convention, Minneapolis, Minn., June 18–19.

EASTERN PHOTOELASTICITY CONFERENCE, 15th semi-annual meeting, University Club, 40 Trinity Place, Boston, Mass., June 20.

MONTANA ASSOCIATION OF COUNTY COMMISSIONERS, Missoula, Mont., June 23–24.

PENNSYLVANIA SEWAGE WORKS ASSOCIATION, annual conference, Carlisle Sewage Treatment Plant, Carlisle, Pa., and Penn-Harris Hotel, Harrisburg, Pa., August 25–26.

PENNSYLVANIA WATER WORKS OPERATORS' ASSOCIATION, annual meeting, Penn-Harris Hotel, Harrisburg, Pa., August 27.

Elections and Activities

PAUL HARRIS of Herrin, was elected chairman of the Southern Illinois Water Plant Operators Association at the organization's annual meeting held recently at Carbondale. Harry O'Banion of Murphysboro, was elected secretary.

THEODORE CRANE, professor of architectural engineering at Yale University, discussed "Engineering Features of Civilian Defense," before a meeting of the Connecticut Section of the American Society of Civil Engineers held re-

80% OF NAVY "E" WINNERS USE KARDEX PRODUCTION CONTROLS*

But did KARDEX help them increase production . . . . . ?

Let's take the case of the Bath Iron Works, up in Bath, Maine. They're building ships for the Navy, flying the Navy's "E", too.

Bath Iron use Kardex for administrative functions vital to their whole production program. ***Procurement,*** for example. ***Personnel, Inventory Control.***

Bath's KARDEX PROCUREMENT RECORD is a "self starter." Shortly before a delivery is due—before it has a chance to hamper production by arriving late—this Kardex record ***signals*** that follow-up action is needed. One clerk handles thousands of outstanding purchase orders—without instructions from "higher-ups."

Bath's KARDEX PERSONNEL SYSTEM is equally self-analyzing. Every important factor—from payroll data to employee aptitude—can be examined and recapped at a moment's notice, in a fraction of the usual analysis time. Again, it's ***signalling*** that does the trick!

Bath's KARDEX INVENTORY CONTROL keeps stock in line with government limits, prevents exhausted stores by accurately estimating production needs. It's the most scientific of all materiel inventory records—yet it's simple enough for the office boy to handle!

Important factors . . . ***Procurement, Personnel, Inventory*** . . . more than mere "paper work." ***Control Factors*** that must be geared to the speed of the production line . . . that ***determine*** the speed of the production program.

That's why 80% of the Navy's crack contractors think of records as an integral part of their production lines. That's why they use Kardex—the ***administrative machine tool*** that gets things done faster . . . smoother . . . without delay.

Mr. War Contractor, if YOU need any administrative machine tools, we've got a big data file over at our office. Plenty on tap there. Experience—proved in practice by the nation's top producers. Look up my number in the phone book. I can get over right away.

YOUR REMINGTON RAND SYSTEMS REPRESENTATIVE.

Serving America with

FACT POWER

Kardex *Production* Controls
Kardex *Procurement* Controls
Kardex *Personnel* Records
Kardex *Progress* Controls
Kardex *Tool Crib* Controls
Kardex *Machine Load* Controls
Kardex *Material* Controls
Kardex *Cost* Controls

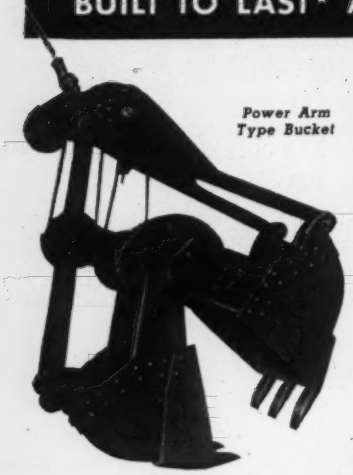
. . . Kardex for every production problem

To April 3, 1942, the Navy had named 183 awards.

REMINGTON RAND

KARDEX *visible systems of* PRODUCTION CONTROL

BUILT TO LAST* AND MOVE DIRT FAST**



Power Arm Type Bucket

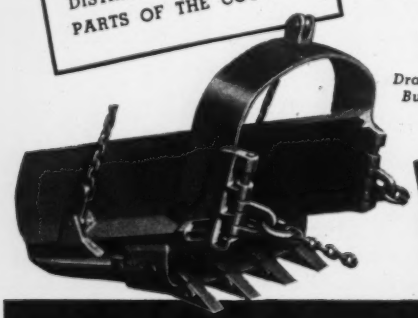
★ **BUILT TO LAST! Every working day for 17 years, a Wellman Bucket has unloaded crushed rock and sand for the Concho Sand and Gravel Co., Oklahoma City. In all that time (17 years) not one cent was spent for repairs or maintenance.**

★★ **FAST? "Our Williams digs and fills in rock and shale better than any other bucket ever used."—*F. F. Mengel Co.* "We have never seen a bucket dig like our Williams does."—*Central Contracting Co.***

Williams users report many benefits like the above experience. They confirm the facts that Williams Buckets are unusually rugged and durable in service and fast in action. It shows too why your next bucket should be a Williams.

DISTRIBUTORS IN ALL PARTS OF THE COUNTRY

Multiple Rope Type Bucket



Dragline Bucket

Each type of Williams Bucket is covered by individual bulletin. Write

The Wellman Engineering Co.
7000 Central Ave. • Cleveland, Ohio

WILLIAMS *Buckets*
built by WELLMAN

DOBBIE

CAT. #9110
1000# CAP.
BRONZE BUSHED
MALLEABLE IRON

Dobbie Foundry & Machine Co.
Niagara Falls, N. Y.
DERRICKS • WINCHES • SHEAVES

"BUFF'S" distinguished reputation is paramount. It is so rich in continuous tradition — that ownership also spells success.

Rental Transits — Reasonable Rates. Send for handsome new catalog #491

BUFF & BUFF INSTITUTE
J. P., Boston, Mass.

THE BUFF "X" TELESCOPE has the finest and highest definition and simplest lens system. It is useful when the light is dim.

cently at New Haven. Arthur B. Harding, Jr., of Yale, and Malcom G. Andrews of the University of Connecticut, were presented with paid memberships as first year junior members of the organization.

The ALABAMA section of the Am.Soc. of C.E. sharply emphasized the place of engineers in the war effort at a two-day meeting held recently at Montgomery.

GUY ACTON, of Birmingham, was re-elected president of the Alabama State Master Plumbers and Heating Association at an annual meeting in Birmingham. Harry Stephens, of Dothan, was elected vice president and Henry Hamill, of Birmingham, treasurer.

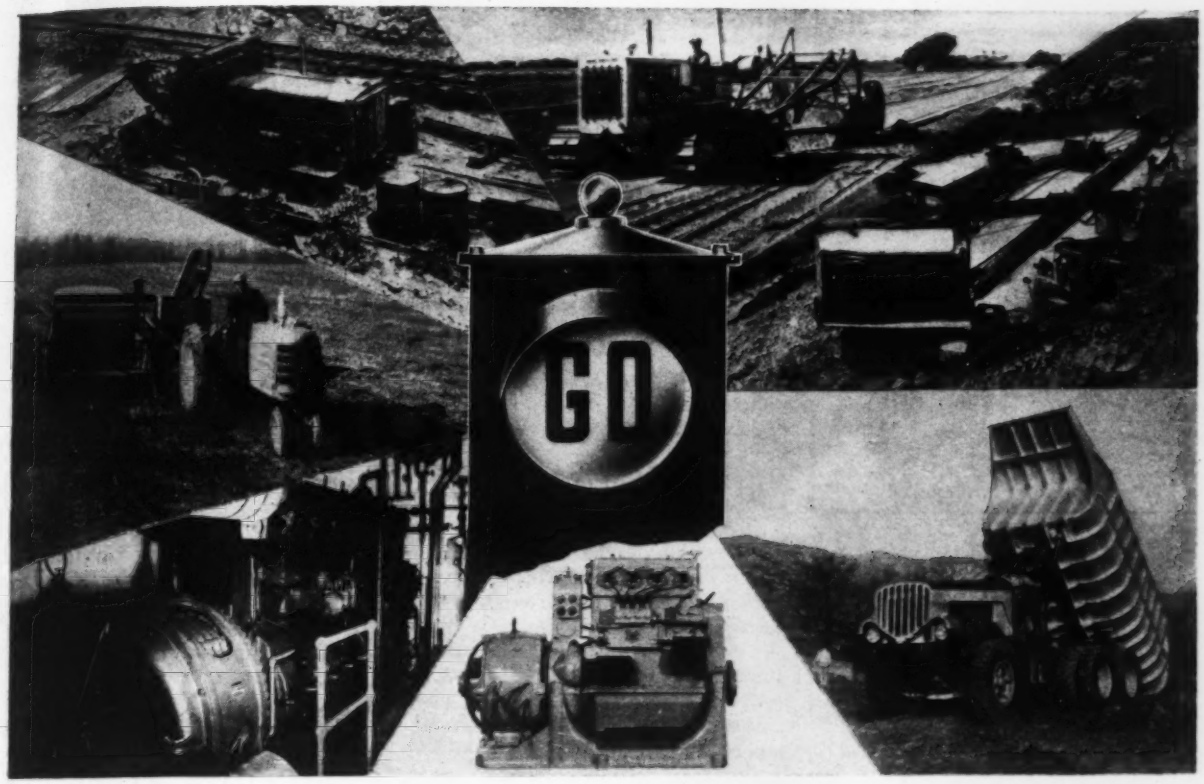
NEW officers of the Minnesota Association of Professional Engineers are: A. C. Leonard, of Rochester, president; Paul V. Burgett, of Eveleth, vice president; A. S. Milinowski, of St. Paul, secretary; E. S. Rankin, of Brainerd, treasurer, and R. R. Herrmann, Minneapolis, president-elect.

THE spring meeting of the governing and advisory boards of the Associated General Contractors of America will be held at the Stevens Hotel, Chicago, June 8–9. The war construction policy, equipment situation, labor relations, priorities, price regulations, contractors' part in civilian defense, are all topics scheduled for discussion.

RAY BENNETT of Pisgah Forest, N. C., was elected president of the Western North Carolina Engineers Club at a meeting held in Asheville recently. Other officers include Julian B. Strepp, Asheville, vice president; J. R. Sechrest of Canton, secretary; Floyd Cotton of Asheville, treasurer, and John Dosier and E. D. Burchard, Asheville, directors.

ABEL WOLMAN, of Baltimore, Md., president of the American Waterworks Association was the principal speaker at a dinner meeting of the Engineering Association of Nashville held at Nashville on May 27.

THORNDIKE SAVILLE, dean of the engineering school at New York University, was elected president of the Metropolitan Section, American Society of Civil Engineers at the section's annual meeting held at Columbia University May 20. William McK. Griffin was elected second vice president. New directors are Morris Goodkind, Harry O. Locher and Col. Louis E. Robbe. William T. Shea was re-elected secretary. Adolph J. Ackerman, director of engineering of the Dravo Corp., Pittsburgh,



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was the speaker. The Junior Branch of the Metropolitan Section, at its annual meeting, elected Archie N. Carter, assistant editor, *Engineering News-Record*, president; Edgar Bishop and C. T. Robenson, vice presidents, Sherman Glass, treasurer, and M. Leonard Cohn, secretary.

D. R. SMITH, of St. John, N. B., was elected chairman of the St. John branch of the Engineering Institute of Canada at an annual meeting held recently. Other officers elected included A. O. Wolff, vice-chairman; G. W. Griffin, secretary-treasurer; C. C. Kirby and C. D. McAllister, members of the executive committee. The group devoted a great part of its time to many phases of air raid precaution work.

ENGINEERING problems of special concern in connection with defense measures were discussed at the sixteenth annual meeting of the Maryland-Delaware Water and Sewerage Association, held recently at Hagerstown. Speakers included A. C. Hutson, assistant chief engineer, Committee on Fire Prevention and Engineering Standards, National Board of Fire Underwriters; H. W. Streeter, senior sanitary engineer, U. S. Public Health Service, Cincinnati; Jeff Corydon, president, Proportioneers, Inc., and N. S. Chamberlain, technical service division, Wallace & Tiernan Co., Inc.

IRVING E. MOULTROP, retired chief engineer of the Boston Edison Co., received the Engineering Societies of New England's certificate of honor at an annual meeting held in Boston recently.

FREDERICK M. BROWNEWELL was elected president of the Columbus Engineers Club recently. Other officers chosen were: T. W. Brannan, vice president, and H. H. Turner, Jr., secretary-treasurer.

RAY L. SCHACT, of Lincoln was elected president of the Nebraska Engineering Society at a recent meeting. Other officers are Glen A. Walker of Omaha, vice president and Phil J. Colbert, also of Omaha, reelected secretary and treasurer.

M. F. TRICE, of Raleigh, a member of the North Carolina State Health Department, was elected chairman of the North Carolina Society of Safety Engineers at a recent annual meeting at Charlotte. Frank M. Culvern of Charlotte was named vice chairman, and Martin Swartz of Greenville was made secretary and treasurer.

THE American Society of Heating and Ventilating Engineers will hold its semi-annual meeting at St. Paul, Minn., June 15–17.

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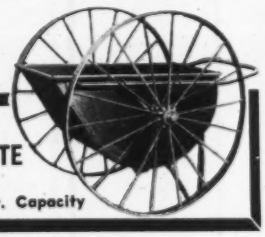

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MEN AND JOBS

J. W. Monk has been named acting supervisor of public utilities for the city of Dallas, Tex.

Ralph L. Priester, formerly project engineer of the Mississippi State Highway Department at Jackson, has been named assistant district engineer at Yazoo City.

Harry J. Harles, Rocky Mount, N. C., architect, has been appointed city building inspector to succeed J. H. Valentine, who resigned recently to enter contracting work.

Arthur Amos, formerly chief engineer of the Quebec Running Streams Commission, has been named to the Quebec City Embellishment Commission.

Thomas E. Collins, city engineer of Elizabeth, N. J., has been appointed a member of the New Jersey State Planning Board.

Harry H. Hendon, Jefferson county, Ala., engineer, has resigned his post to enter private work.

Joe Thames, former office engineer in the Montgomery, Ala., office of the Alabama State Highway Department, has joined an Army motor repair unit.

Perry Helms has become superintendent of the sewer department of Myrtle Beach, S. C.

Lieut. Col. Wayne S. Moore, formerly executive officer of the Mobile, Ala., Engineer District, has been appointed district engineer at Wilmington, N. C. succeeding **Lieut. Col. Robert A. Sharrer,** who has been assigned to other duties.

William H. Harrelson, general manager of the Golden Gate Bridge and Highway District at San Francisco since 1939, has resigned because of illness.

Hugo G. Erickson, city paving engineer in the Minneapolis city engineer's office, has been called to active service in the Army Air Corps.

George A. Geib, St. Paul, has been named regional engineer for the Federal Works Agency, Region 8, with headquarters in Kansas City, Mo.

Kenneth F. Dodge, of Boone, Iowa, has been named WPA project engineer for Wapello, Mahaska and Davis counties.

Phil Smith, city engineer and assessor of the City of St. Peter, Minn., has resigned to accept a new position as engi-

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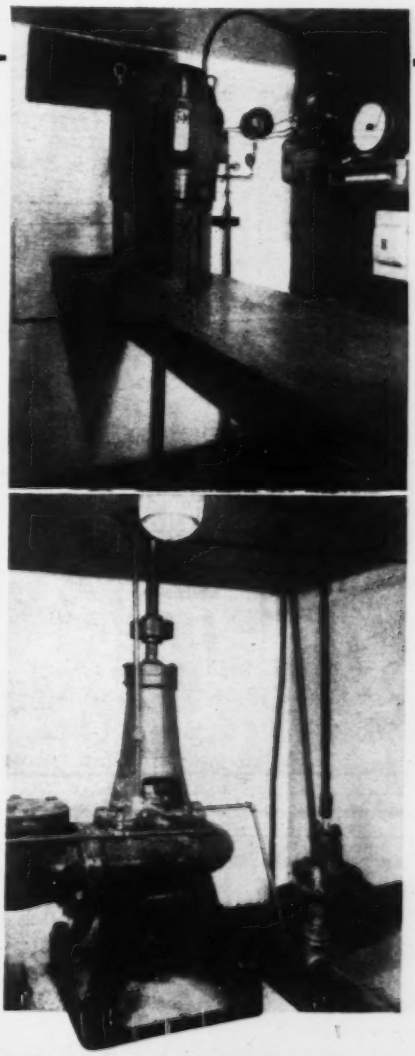

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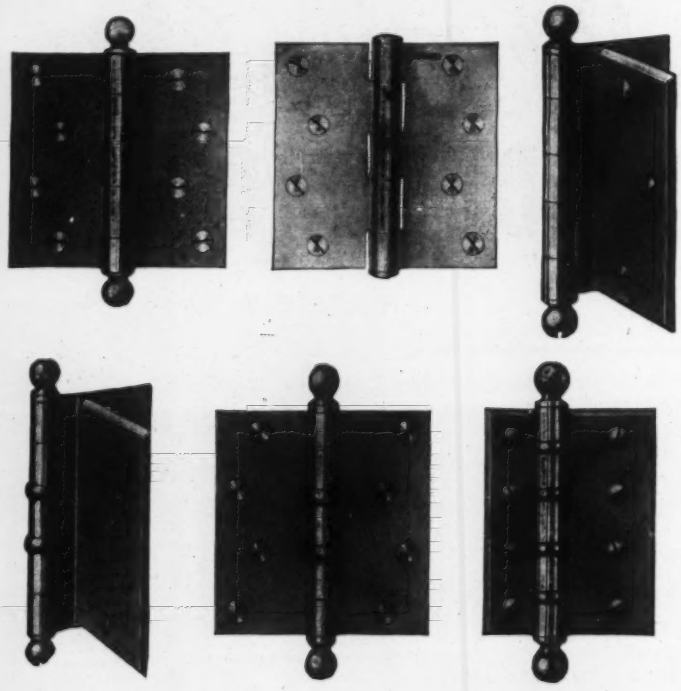

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neer and purchasing agent for the village of Edina, Minneapolis suburb.

Edwin F. Jones, engineer for the Department of Public Utilities, St. Paul, Minn., has been appointed transportation administrator for that city.

F. B. Patterson, engineer for the South Dakota State Highway Commission, has resigned to accept a position with the Civil Aeronautics Authority.

William G. Sloan, of Princeton, former New Jersey Highway Department Engineer, will supervise repair of the Central Highway between Pinar del Rio in Northwest Cuba and Santiago, according to an announcement by the Cuban National Development Commission.

Maj. George Kumpe has been named district engineer for Milwaukee, succeeding **Col. Arthur Pence,** who was transferred to an unannounced post almost immediately after his assignment at Milwaukee had been announced.

O. J. Bach, Waterloo, Ia., architectural engineer, is now at Eau Claire, Wis., where he is employed in inspection of a site for a defense plant.

Harold E. Bechtel, architect at Fargo, N. D., has discontinued his practice there for the duration of the war, and accepted a post with Wyatt C. Hendric, Inc., architects and engineers of Fort Worth, Tex.

Lieut. Jerome O. Ackerman, formerly in charge of design and specifications in the St. Paul, Minn., office of the U. S. District Engineers, has been appointed area chief engineer in charge of the Gopher Ordnance plant.

Addison H. Douglass, Minnesota state director of the Public Work Reserve, has been commissioned a Major in the Corps of Engineers.

C. P. Freeman, formerly resident engineer at Wilmington, for the North Carolina State Highway and Public Works Commission, is now located with the U. S. Engineer Office at Wilmington.

A. H. Stevenson, formerly with the New York State Health Department at Gouverneur has been commissioned a First Lieutenant in the reserve of the Public Health Service and is stationed in the service's New York headquarters.

John Molloy, formerly a member of the engineering department of the city of Hartford, Conn., is now in active service with the U. S. Navy.

Gilbert C. Morton, former WPA con-

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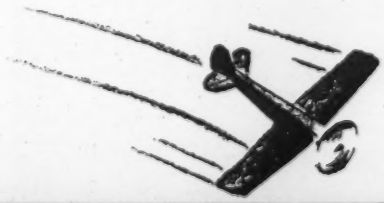

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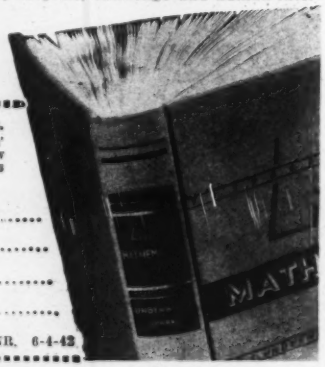

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struction superintendent in New Hanover County, N. C., has been named city building inspector at Wilmington, N. C.

John M. Anderson, of Ames, Ia., has been named field engineer in Minnesota for the Structural Clay Products Association. He will make his headquarters at Mankato.

Hillman Estenson, engineer of the Superior, Wis., Public Works Department, is preparing a new city building code.

J. G. Smith, member of the Wyoming State Highway Department for over 25 years, and district engineer at Cheyenne, has resigned to enter private employment.

Kenneth Markwell, PWA project manager for the Santee-Cooper development in South Carolina, has been appointed project supervisor at High Point, N. C., where a dam and hydroelectric development is under construction.

Harry H. Hendon, chief engineer of Jefferson County, Ala., has resigned to accept private employment.

Weston L. Walker and **Herman L. Bowen,** senior engineers with the Los Angeles County flood control district, have been called to active service in the Corps of Engineers. Both were commissioned as Captains.

P. S. Monk has been granted a leave of absence from his post as bridge designer for the South Carolina State Highway Department, in order to join J. E. Sirrine Co., engineers, of Greenville, S. C., on construction of an army ammunition depot.

James O. Litchford, senior office engineer in the North Carolina State Highway Public Works Commission, and **James P. Dodge,** senior claim engineer, have been called to active service with the U. S. Army.

Ray Campbell has been named city engineer of Laramie, Wyo.

Paul Bailey, of Denver, Colo., head of the bridge division of the Colorado State Highway Department, has been commissioned a Captain in the Corps of Engineers.

Harry F. Reid, Jr. has been appointed research engineer on the technical staff of Battelle Memorial Institute at Columbus, Ohio.

H. R. Pipkin, resident engineer for the Texas State Highway Department at Fort Worth has been called to active duty with the U. S. Navy.

NEW PUBLICATIONS

Gypsum Lath—A handsomely printed booklet on gypsum lath, containing the most up-to-date information on gypsum lath and providing proof of its fire resistance, bond, bracing strength, crack resistance, permanence, speed of erection and economy, has been issued by the Gypsum Association. The three types of gypsum lath—plain, perforated, and insulating are fully described. Also included are facts about lath including sizes, weight, fire resistance ratings, sound transmission, insulation, and the value of insulating gypsum lath as a vapor barrier. An architect's specification is included.—*Gypsum Association, 211 W. Wacker Drive, Chicago, Ill.*

Production and Morale—A booklet called "More Production, Better Morale," has been issued by the Bedaux Co., Inc., and attempts to show production engineers the problems of proper planning and scheduling of operations, job evaluation and classification, plant layout, training of supervisors and workers, control of maintenance and repair operations, and control of costs. In applying these techniques, the statement points out, it is essential to enlist the workers' collaboration.—*The Bedaux Co., Inc., Chrysler Bldg., New York, N. Y.*

Emergency Service—Issued by the Plymouth Cordage Co., War Emergency Service Book No. 3 is now available to assist rope users in making necessary adjustments by explaining causes and necessities forced by the war program. The book places specific emphasis on the company's "wartime" rope and its possible uses in place of manila rope, and suggests points where the rope can be used. It explains that the technique of making the rope will remain on a level with high standards previously established by the company, although materials necessarily will be less than manila.—*Plymouth Cordage Co., North Plymouth, Mass.*

Non-metallic Gears—A complete, up-to-date story on non-metallic gears, which incorporate the latest improvements in one of man's earliest inventions, is contained in a new booklet just published by General Electric Co., Plastics Division. For more than 30 years, the G.E. plastics division has been developing non-metallic gears which are now 30 to 40 times as resilient as steel, absorb vibrations and reduce operating noise and will not corrode or rust. Case histories of some applications show a useful life of as much as ten times that of metal gears in the same application. The booklet describes the two types of non-metallic gear material, Fabroil and Textolite.

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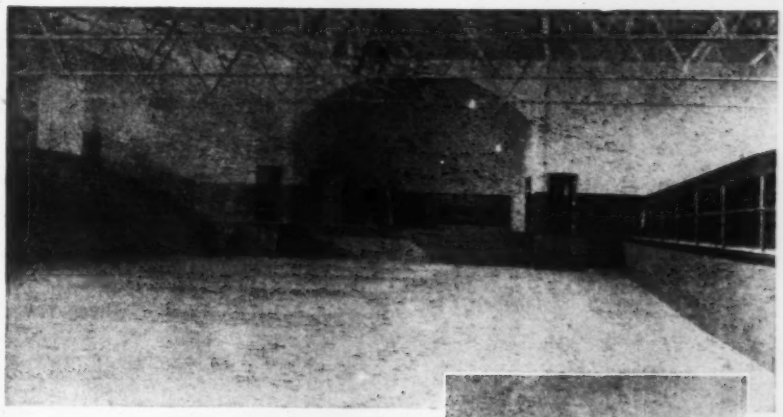
Fabroil consists of compressed cotton fibers, held together by steel shrouds and threaded studs. Textolite gears consist of woven fabric laminations held in compression by a phenolic resin.—*General Electric Co., Plastics Div., Pittsfield, Mass.*

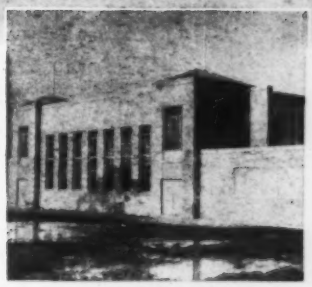
Wiring—A new 24-page catalog on General Electric wiring for underfloor electrical distribution in cellular steel floors has been announced by the conduit products sales section of General Electric's appliance and merchandise department. G.E. fittings and accessories, illustrated and described in the catalog, provide for the use of the hollow cells of Q-floors as raceways for wiring, thus making virtually the entire floor available for electrical services. Six basic types of Q-floors are described.—*General Electric Appliance and Merchandise Department, Bridgeport, Conn.*

Selector—A 64-page 1942 revision of the "Quick Selector Catalog" is announced by Westinghouse Electric & Mfg. Co. Issued twice a year, this catalog has become extremely popular as it simplifies the selection of many types of electrical equipment. The general subjects covered include: safety switches, no-fuze breakers, multi-breakers, panelboards, motor control and motors. New application data, on latest equipment in each of these groups, has been included. —*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.*

Acetylene Torches—A new issue of "Oxy-Acetylene Tips," published by the Linde Air Products Co., stresses thorough operator-understanding of the setting up of welding and cutting equipment, operation and maintenance. Taking into account the tremendous expansion of industry which has brought many new operators into the field, the article describes how to connect oxygen and acetylene regulators, how to put on hose connections, how to attach the blowpipe and how to test for leaks. Well illustrated, it leaves nothing to the imagination in explaining these processes.—*The Linde Air Products Co., 30 East 42nd St., New York, N. Y.*

Guide Book—A guide book for DO-ALL operators called "A Chalk Talk on 40 Different Ways to Cut Machining Costs," is now available. The book has been written especially for the thousands of machinists who are called upon to operate the DOALL contour sawing machines, even though they have had little or no training in contour machining. From the pocket size booklet, they are shown ways in which experienced DOALL operators have saved themselves time and metal in their machining practices.—*The Continental Machines, Inc., Minneapolis, Minn.*





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★ In planning the modern and efficient National Guard Armory at Maryville, Tennessee, the architects, Fred Manley Associates, Knoxville, Tenn., specified installation of Carey Rock Wool above the ceilings, about two carloads of this product being used for the purpose. Carey Rock Wool was selected for this job because of its known efficiency and dependability.

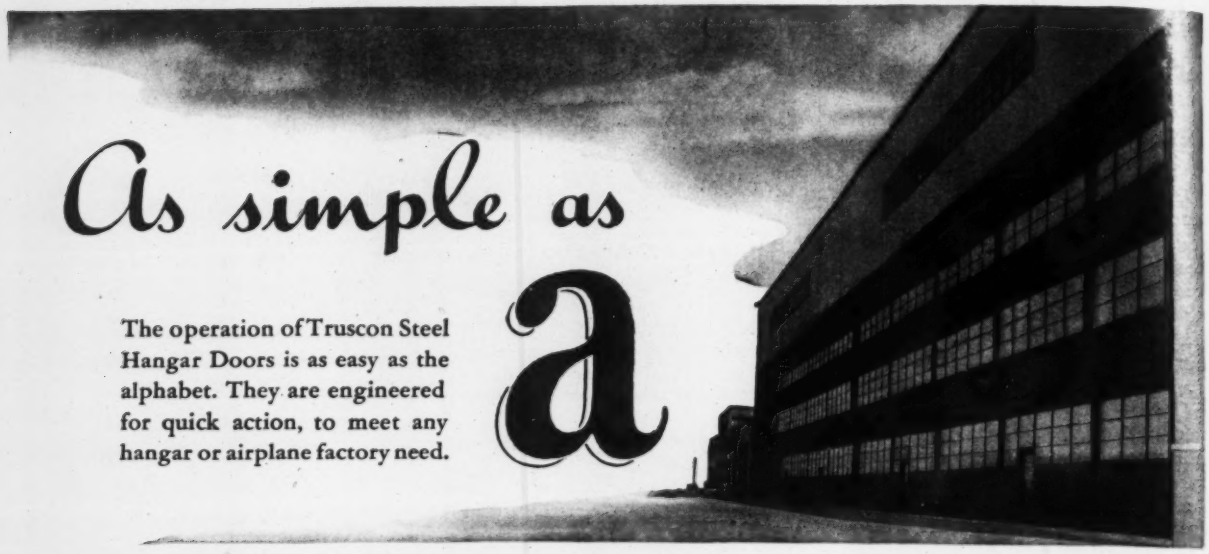
Tests by Mellon Institute of Industrial Research and other responsible organizations certify to the high quality of Carey Rock Wool. You insure maximum desirable results when you specify CAREY Insulations. See Catalog in Sweets or write for full information. Address Dept. 30.

THE PHILIP CAREY MFG. COMPANY
DEPENDABLE PRODUCTS SINCE 1873
LOCKLAND, CINCINNATI, OHIO

In Canada: The Philip Carey Company, Ltd. Office and Factory: Lennoxville, P. Q.

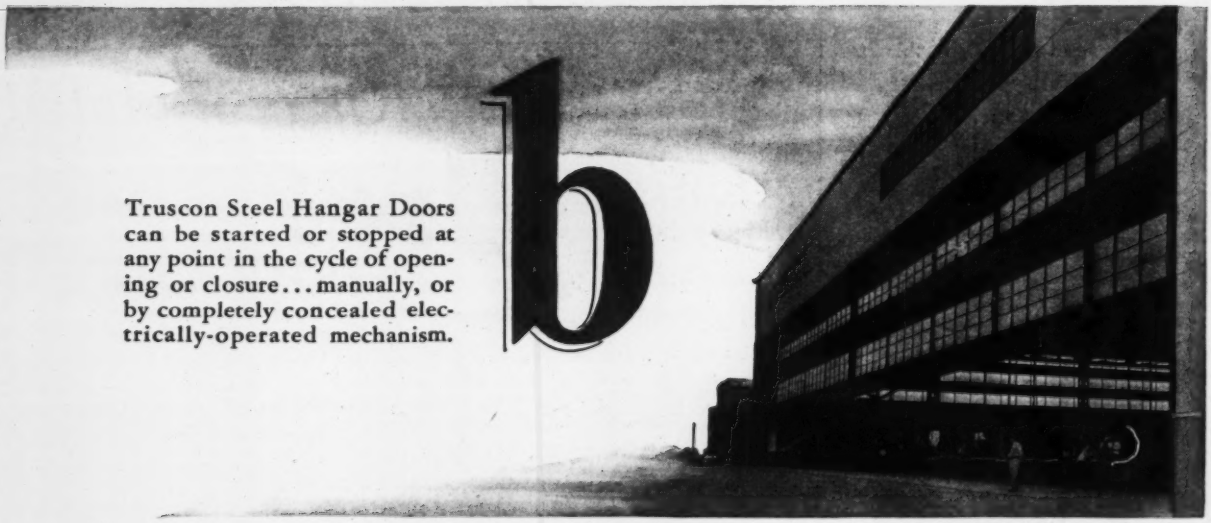
As simple as a

The operation of Truscon Steel Hangar Doors is as easy as the alphabet. They are engineered for quick action, to meet any hangar or airplane factory need.



b

Truscon Steel Hangar Doors can be started or stopped at any point in the cycle of opening or closure... manually, or by completely concealed electrically-operated mechanism.



c

Door area requirements of any width or height can be met. See pages 52-63 of Truscon's catalog in 1942 SWEET'S for complete specifications and details.

TRUSCON STEEL COMPANY • Youngstown, Ohio

51 Sales Engineering Offices • 27 Warehouses

Subsidiary of Republic Steel Corporation